amateur radio

Vol. 38, No. 4

APRIL, 1970

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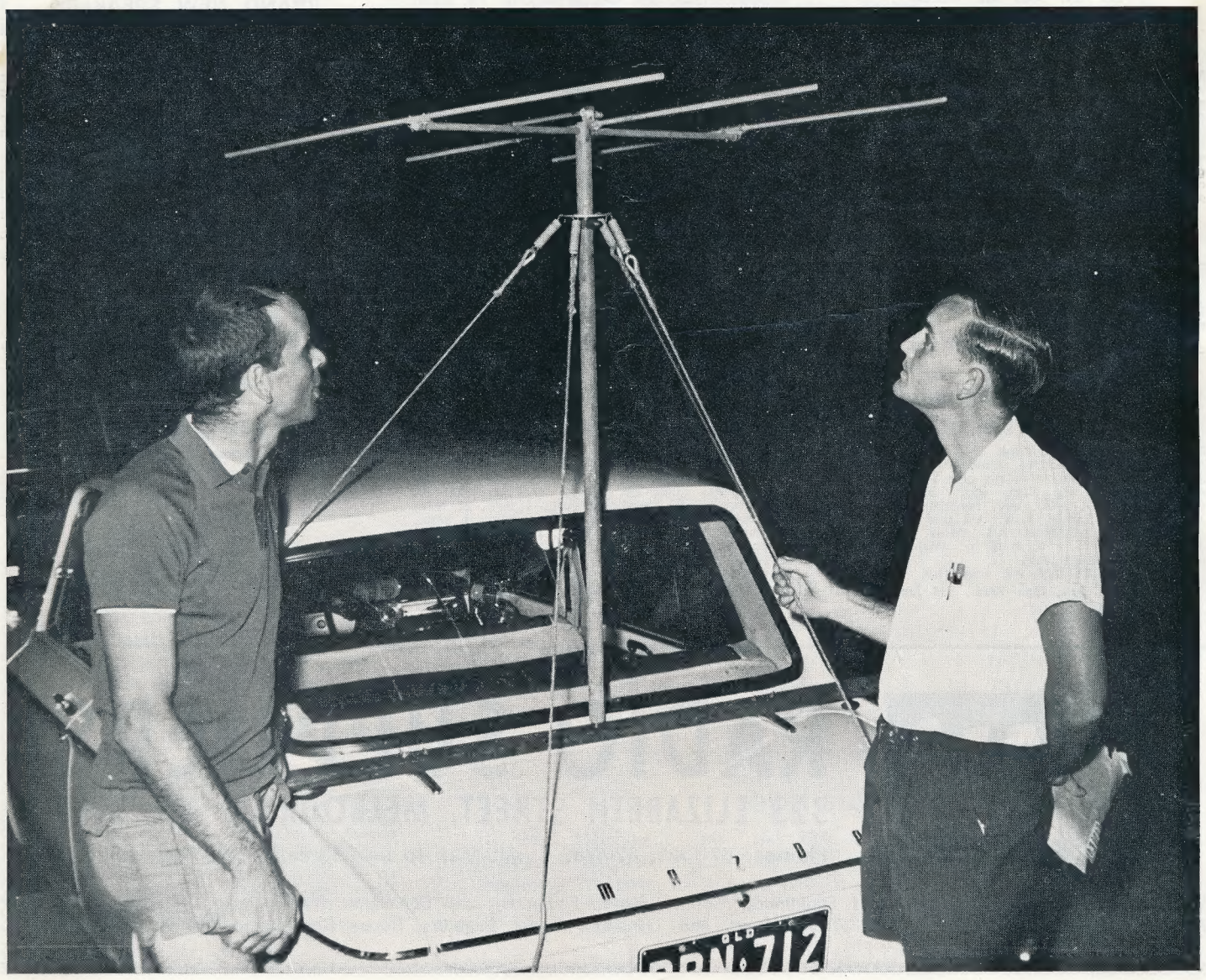

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amateur radio

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COVER STORY

Wolf Melchhardt (left) and Rick Sayers, VK4ZRS (right) of the Townsville Amateur Radio Club. Picture shows ingenious method of mounting 3 el. beam for 2 metre tx hunt on back of VK4EX's small sedan.

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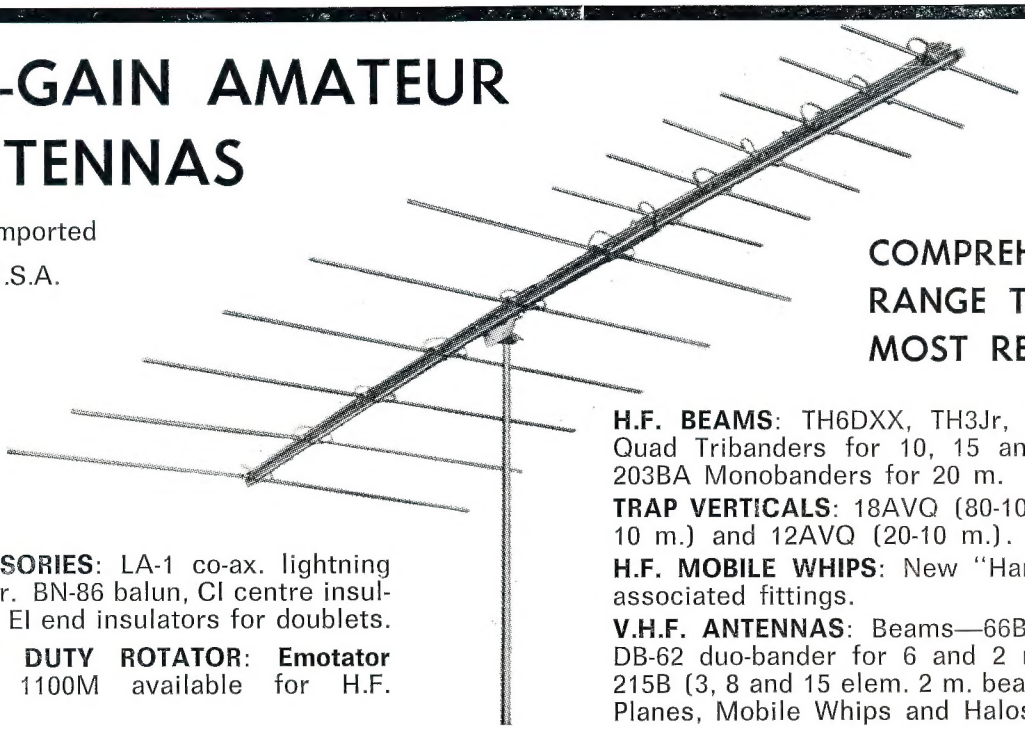

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THE WHEATSTONE BRIDGE

LECTURE No. 4

C. A. CULLINAN,* VK3AXU

The purpose of this lecture is to provide further practice with Ohms Law, and leads to the development of a practical Wheatstone Bridge suitable for measurement of Resistance, Capacitance and Inductance.

The Wheatstone Bridge is a device for accurate measurement of Resistance, Capacitance and Inductance.

The basic bridge was invented in 1833 by Samuel Hunter Christie, but no practical applications for its use were developed until 1843. In that year, Sir Charles Wheatstone applied Ohms Law to the bridge network in connection with problems in telegraphy.

As a result of this work the bridge has been known ever since as the Wheatstone Bridge.

Now-a-days there are many variations of the Wheatstone Bridge, these having been developed for specific purposes.

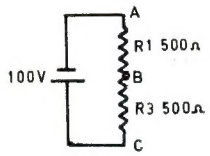

Fig. 1.

Consider the circuit of Fig. 1. Let each resistance be exactly 500 ohms and assume that the battery has no internal resistance. We know from d.c. theory that the total value of the two resistances will be 1,000 ohms.

We also know from our studies of Ohms Law that the voltage between A and B will be exactly the same as between B and C.

Let us prove this.

Firstly, we have to find the current (I) flowing in the two resistances.

From Ohms Law,

$$I = E \div R$$

$$\text{therefore } I = 100 \div 1{,}000$$

$$= 0.1 \text{ ampere or } 100 \text{ milliampere.}$$

Next find the voltage between A and B.

Transposing Ohms Law formula,

$$E = I \times R$$

$$\text{therefore } E = 0.1 \times 500$$

$$= 50 \text{ volts.}$$

Now, since in our problem each of the two resistances is exactly equal to the other, then the voltage between B and C is also 50 volts.

The next step to develop the Wheatstone Bridge is to add two more resistances, each of exactly 500 ohms, wired in series and the combination connected in parallel across the battery (see Fig. 2).

Since R2 and R4 are exactly the same in value as R1 and R3, it follows that the current flowing in R2 and R4 is also 0.1 ampere.

* 6 Adrian Street, Colac, Vic., 3250.

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

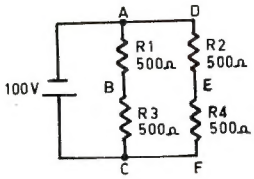

Fig. 2.

Therefore the voltage between D and E will be 50 volts, and between E and F, 50 volts.

We also know from d.c. theory that the current which flows in R1 and R3 flows in the same direction as the current in R2 and R4.

Therefore it becomes obvious that as the voltage at both B and E is 50 volts in respect to either the positive or negative pole of the battery, and as the polarity must be the same at both B and E, then there cannot be any difference of voltage, or potential difference, between B and E.

PRACTICAL EXPERIMENT

Connect a voltmeter of a type which does not consume current (such as a vacuum tube voltmeter) between points B and E. We will not be able to read any voltage.

Next let us remove the voltmeter and replace it with a sensitive ammeter.

This ammeter will have some resistance and we can now re-draw the circuit (Fig. 3) to show this ammeter.

In practice it would be a microammeter having the pointer in the centre of the scale when no current is flowing. A current of 100 microamperes in either a positive or negative direction will cause the pointer to move full scale, either right or left. Such a meter is known as zero centre meter.

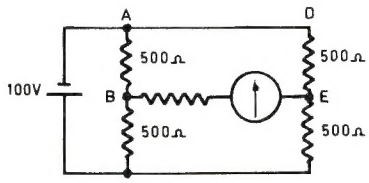

Fig. 3.

It will be found that no current will flow in the ammeter, **because there is no potential difference between B and E.**

What we have done so far is to prove that when R1, R2, R3 and R4 are exactly equal, no current will flow in the ammeter.

Suppose now that we change the value of the resistors. Let us make R1 and R2 each exactly 750 ohms and R3 and R4 250 ohms.

Using the formulae shown previously we find that the voltage between A and B, and also between D and E, will be 75 volts each, and between B and C, and also between E and F, will be 25 volts each. Once again no potential difference will exist between B and E, therefore no current can flow in the ammeter.

If we continue this type of analysis we find that if R1 and R2 are exactly equal and, if R3 and R4 are also equal, although R1, R2, R3 and R4 can be widely different (say 999 ohms each for R1 and R2, and 1 ohm for R3 and R4), then no current will flow in the ammeter. **Calculate these figures and verify this statement.**

But if we change the value of any one of the resistors, then current will flow in the ammeter because a potential difference will exist between B and E. Let us go back to our circuit and change the resistor values a little as shown in Fig. 4, for example. (Note erratum in the value of R4; this should read 100 ohms.)

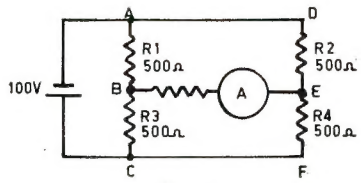

Fig. 4.

Note.—The value of R4 as shown is incorrect. R4 should read 100 ohms.

From our previous calculations we know that the voltage at B is 50 volts in respect to either A or C. However the voltage at E will be:

Between D and E, 83.33 volts,
and between E and F, 16.66 volts.

(Because of the recurring decimals, the total calculated voltage is not 100, but this does not matter in this calculation because it is sufficiently accurate.)

We now see that a potential or voltage difference exists between points B and E. Measure this with a vacuum tube voltmeter.

Now if we connect our ammeter between B and E it will show a current flow. Because of this current flow through the ammeter, our calculations above will not be exactly correct although they are for the vacuum tube voltmeter. Again we need not worry about this discrepancy.

We have now established the following regarding the Wheatstone Bridge:

1. If resistances R1 and R2 are equal to each other, no current flows in the ammeter if resistances R3 and R4 also are equal to each other. In other words, the Bridge is in a **balanced** condition.
2. If resistances R1 and R2 are equal to each other, current will flow

in the ammeter if resistances R3 and R4 are not equal to each other. The Bridge is **unbalanced**.

3. If resistances R1 and R2 are equal to each other and if either R3 or R4 is adjusted so that they become equal to each other, the Bridge becomes balanced and current will cease to flow through the ammeter.

4. If resistances R1 and R2 are equal to each other and either R3 or R4 is made an accurately calibrated variable resistance, then if we connect an unknown resistance for the remaining resistor we can measure the value of the unknown resistance by adjusting the calibrated resistance until no current flows in the ammeter, indicating that the bridge is balanced. We then read the scale or calibration of the calibrated resistor to give us the value of the unknown resistance.

Therefore Bridge Balance is obtained when R1 ÷ R3 = R2 ÷ R4.

Further mathematical analysis will show, too, that Bridge Balance can be obtained when R1, R4 = R2, R3.

A SIMPLE PRACTICAL BRIDGE

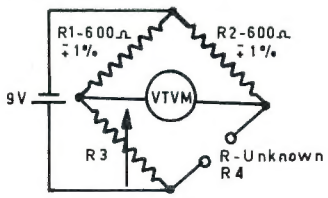

Fig. 5.

R3 is an adjustable, calibrated resistor, known as a decade resistance box. It can be adjusted in steps of 1 ohm from 0 to 1,111,110 ohms.

It consists of six switches. Each switch has one moving pole and eleven positions (Fig. 6). Position 1 is 0 ohms.

Switch 1 has 10 resistors each 1 ohm ±1%, knob marked × 1.
Switch 2 has 10 resistors each 10 ohms ±1%, knob marked × 10.
Switch 3 has 10 resistors each 100 ohms ±1%, knob marked × 100.
Switch 4 has 10 resistors each 1,000 ohms ±1%, knob marked × 1K.
Switch 5 has 10 resistors each 10K ohms ±1%, knob marked × 10K.
Switch 6 has 10 resistors each 100K ohms ±1%, knob marked × 100K.

The switches are wired in series.

The IN on the first switch and the OUT on the last switch are wired to terminals on the box so that it can be connected into various circuits.

The resistors are high stability types and the switches of good quality, preferably ceramic.

In a precision box artifically aged wire-wound resistances would be used.

PRACTICAL WOFK

The following items are available:—

Two 600 ohms ±1% resistors.
One decade resistance box as described above.
One 9v. battery.
One vacuum tube voltmeter. The meter can be set to half scale electrically to give a centre zero meter and use the 1½ volts d.c. range for the bridge.
One centre zero micro-ammeter, 100-0-100 μA.

Make up the above bridge using these components (Fig. 5). Use a number of different resistors as the unknown and balance the bridge with the decade resistance box. Note that sometimes an exact balance cannot be obtained because the exact value lies between two successive 1-ohm steps.

For normal practical radio work this bridge will measure resistors within its range with sufficient accuracy.

Balance occurs when R1 ÷ R3 = R2 ÷ R4, or

R1, R4 = R2, R3.

Thus R4 = (R2 × R3) ÷ R1.

Therefore R4 = R3 (R2 ÷ R1).

This means that R4 must always be equal to the value of R3 times the multiplying factor (R2 ÷ R1).

If some fixed value is set for R1, then a change in R2 alone will change the multiplying factor.

Now this means that we can expand the usefulness of the original bridge to cover far greater values of R4, and this gives us a means of measuring a wide variety of resistance values if we allow R4 to represent each of these known resistances. Let us call R4, R unknown R_U or R_X. (The u or x signifying unknown.)

We can design, now, a more practical bridge than our earlier one.

Firstly, make R1 two precision resistors; 1,000 ohms and 10,000 ohms, with a switch so that either can be used, will be very suitable. The 1,000 ohm resistor used in one position only.

Secondly, R2 can be a number of switched precision resistors so that we can alter the ratio of R1 to R2. It is desirable that the resistors for R2 change in the ratio of 10-1 to make mental calculations easy. Thus R2 can be resistors one each of 1 ohm, 10 ohms, 100 ohms, 1,000 ohms, 10,000 ohms and two of 100,000 ohms.

The multiplying factors we get will be:—

R2 ÷ R1 = 1 ÷ 10,000
10 ÷ 10,000
100 ÷ 10,000
1,000 ÷ 10,000
10,000 ÷ 10,000
100,000 ÷ 10,000
and 100,000 ÷ 1,000.

In decimal equivalents these are: 0.0001, 0.001, 0.01, 0.1, 1.0, 10.0, and 100.0.

Thirdly, let R3 be a calibrated adjustable resistance of maximum value of 10,000 ohms. It can be a calibrated rheostat or a decade resistance box.

Referring back to our previous formula, R_X = (R2 × R3) ÷ R1 = R3 (R2 ÷ R1).

Now let us assume that R3 is set for 100 ohms and that R2 is switched to its 1 ohm resistor, then the bridge will balance only when R_X, the unknown, is 0.01 ohm, i.e. R3 = 100 ohms. Ratio (R2 ÷ R1) = 0.0001 = 100 × 0.0001 = 0.01 ohm.

At the other end of the range of measurement of the instrument let the balance of the bridge be obtained with R3 at maximum resistance, 10,000 ohms, R1 switched to 1,000 ohms and R2 switched to 100,000 ohms. The ratio of R2 ÷ R1 = 100, so the value of the unknown resistance R_X is R3 × 100 = 10,000 × 100 = 1 megohm.

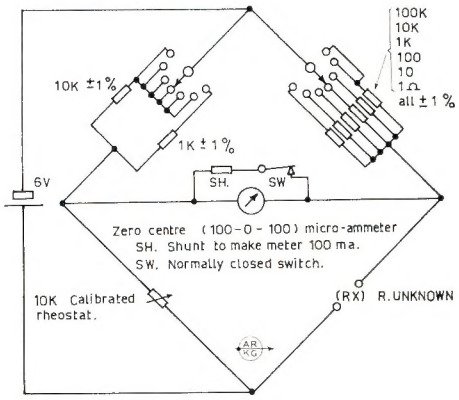

Fig. 7.
Note that only one 100,000 ohm resistor is used in R2 by paralleling the 6th and 7th contacts of the switch.

Depending on how small R3 can be set, in its minimum position, the range of measurement will be from 0.001 ohm (if R3 is 10 ohms) to 1 megohm, and the accuracy will depend on the degree of precision of all the resistors in use.

In many bridges R3 is a 10,000 ohms rheostat which has been calibrated so that 100 ohms is marked 0.1, 500 ohms 0.5, 1,000 ohms 1.0, 5,000 ohms 5, and 10,000 ohms 10, with appropriate markings in between.

(In practice, a bridge of this type can be made to measure to 0.001 ohm although theoretically it could go to 0.0001 ohm.)

The switch for the multiplying or ratio resistors R2 is marked with the multiplying factor. When balance is obtained it is only necessary to read the numerical calibration of R3 and multiplying by the multiplier with simple mental arithmetic.

The next part of this lecture will deal with variations of the Wheatstone Bridge using a.c. as the power source and will conclude with a description of a versatile general-purpose bridge.

ALTERNATING CURRENT RESISTANCE MEASUREMENTS

The Wheatstone Bridges described so far use d.c. for the power source and a sensitive ammeter as the null or balance indicator.

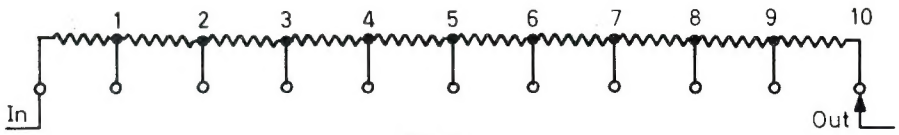

Fig. 6.

However, it is possible to use an alternating current as the power source and a pair of headphones to detect the null or balance when obtaining the d.c. resistance value of a resistance.

If an audio frequency oscillator, operating at 1,000 cycles per second, is connected in place of the battery as the power supply, then this tone will be heard in a pair of headphones, which are connected in place of the meter, except when the bridge is in perfect balance, and sometimes this is the preferred method to use.

However, it is essential that the a.c. resistance or reactance of the resistor being measured is very small, and not greater than the reactance of the various resistances used in the bridge. For instance, if the bridge is made from non-inductive resistors or resistors having negligible reactance at 1 KHz., then if a highly inductive resistor is used as the unknown, a proper balance would not be obtained.

However, it is possible to balance out the reactive component by connecting a condenser across one of the other arms of the bridge.

THE WHEATSTONE BRIDGE FOR MEASUREMENT OF CAPACITANCE

We have already seen that the Wheatstone Bridge can be used with a source of alternating current for the measurement of resistance, and since a capacitance will pass an alternating current, but will block a direct current, it would appear feasible to use an a.c. version of the Wheatstone Bridge to measure capacitance, and we will find that this is so although the bridge has to be arranged a little differently to the resistance bridge.

The reactance of a capacitance (condenser) is known as X_c and is derived from the formula X_c (in ohms) $= 1 \div 2\pi FC$, where F is any frequency in Hertz (cycles) per second, C is the capacitance in farads.

Let us find the reactance of a condenser of 0.01 μF. at 1,000 Hz. (cycles per second).

Then $X_c = 2 \times 3.14 \times 1000 \times 0.01 \times 10^{-6}$.

If the reactance of some condensers is calculated to three significant figures at the same frequency, it will be seen that the reactance of a condenser varies in inverse proportion to its capacity, i.e. at 1,000 Hz.:

0.001 μF.	= 159,100	ohms
0.01 μF.	= 15,910	,,
0.1 μF.	= 1,591	,,
1.0 μF.	= 159	,,

Obviously from this we cannot substitute an unknown condenser in place of the unknown resistance (R_x) in our resistance bridge.

However, let us examine the situation with our simple bridge if we substitute a known value of capacitance for one of the ratio arms of the bridge (Fig. 8).

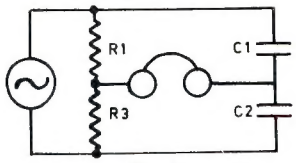

Fig. 8.

Referring to our earlier discussion of the development of the Wheatstone Bridge, we can apply the same reasoning to this new circuit.

If the resistance of R1 equals the reactance of C1, and if the resistance of R3 equals the reactance of C2, then the bridge will balance. (This statement is a simplification of the system.)

The formula for balance is:—

$$\frac{R1}{\frac{1}{C1}} = \frac{R3}{\frac{1}{C2}}$$

$$\text{or } \frac{R3}{C1} = \frac{R1}{C2}$$

$$\text{This becomes } C1 = \frac{R3}{R1}(C2).$$

Therefore we make C2 a condenser of known value, of good quality and high accuracy and use it as a standard of reference.

The bridge now appears as shown in Fig. 9.

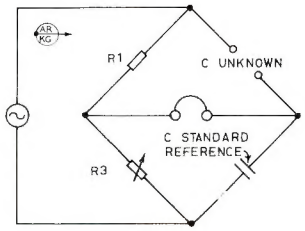

Fig. 9.

We can easily make this bridge more practical and incorporate in it some of the resistances used in our more elaborate d.c. resistance bridge.

Firstly, we change the previous bank of multiplier resistances over to the R1 position, leave R3 the calibrated variable resistance and use two switched standard condensers in place of the previous unknown resistance R_x. C_U, the unknown condenser, takes the place of R2.

However, we still have a problem to solve.

Condensers have internal resistance and this can vary considerably. The losses in condensers cause the power factor of condensers to differ widely and unless the power factor of the unknown condenser is equal, exactly, to that of the standard reference condenser, then the bridge will not balance because the phase shifts will not be the same.

Now precision condensers are necessarily good condensers and they are expensive, but they will have very low losses hence the power factor will be low.

If a condenser could be manufactured without losses then its power factor would be zero and if a resistance were added in series with it, then the combination would represent a condenser with losses.

Now if the standard reference condenser is a really good one, with negligible losses, then we could add a variable resistance in series with it to make its power factor the same as that of the unknown condenser (unless the unknown has an even better power factor, a rather unlikely situation if we make a good bridge).

An expression for the approximate power factor is:—

$$\text{Power factor} = \frac{R}{\frac{1}{2\pi FC}}$$

$$= R\,(2\pi FC)$$

where R is the value of the series resistance of the condenser, and $1 \div (2\pi FC)$ is the reactance of the condenser.

This is known as the Dissipation Factor, CD.

In order to cover a wide range of capacitance measurement, it is desirable to use two standard reference condensers, one of 0.01 μF. and the other 0.1 μF. Both should be high quality mica condensers, not paper dielectric types as the mica ones will have lower losses.

Each condenser should be accurate in its value to within $\pm 1\%$.

Let us see what happens if we calculate the power factor for the 0.01 μF. condenser at 1,000 Hz. from the above formula.

Power factor (Pf) =

$$6.28 \times 1{,}000 \times 0.01 \times 10^{-6}$$
$$= 0.0000628$$

assuming the condenser has negligible losses.

If we wish to be able to compensate for unknown condensers having a power factor up to 1.0 we must put a variable resistor in series with our 0.01 μF. condenser so that it will appear to have a power factor of 1.0.

If we calculate the maximum value of this resistor we will find that one of 16,000 ohms will give a power factor of 1.0048, i.e. $0.0000628 \times 16{,}000 = 1.0048$. Whilst 0 ohms will give a power factor of 0. Therefore various resistance values between 0 and 16,000 ohms will enable us to obtain power factor or dissipation factor adjustments between 0 and 1.

However in order to use the 0.1 μF. standard condenser it would not be practicable to utilise the 16,000 ohms variable resistor but one of one-tenth this resistance would be suitable.

In practice, it may not be possible to obtain variable resistances of exactly 1,600 and 16,000 ohms, so that it would be necessary to use standard rheostats or potentiometers of 2,000 and 20,000 ohms respectively and ignore the resistance above either 1,600 ohms or 16,000 ohms.

Each of these two resistances can be calibrated 0-10 and given simple multiplying factors to make the bridge more readily useable.

In bridge terminology the 16,000 ohms variable resistor is known as a DQ resistor and the 1,600 ohms variable resistor is labelled CD. The switch used to change from one to the other is labelled CDQ.

The practical bridge now appears as shown in Fig. 10.

To operate the bridge, S1 is set to the approximate range for the condenser to be measured. R2 is then varied for minimum sound in the headphones. S2 is switched to CD and the CD resistance varied, together with R3. If a proper null cannot be found, S2 is switched to DQ and the DQ resistor

varied, together with R3. There may be some interlocking between R3 and either the CD or DQ resistors. Also, it may be necessary to alter the setting of switch S1. It may not be possible to get a complete null but the one obtained should be very deep. Stray capacity to ground in the 1,000 Hz. generator, and other stray capacities, may make a complete null impossible.

Some experience is desirable in learning to adjust this type of bridge so at the start the student should use well marked condensers for the unknown in order to obtain practice.

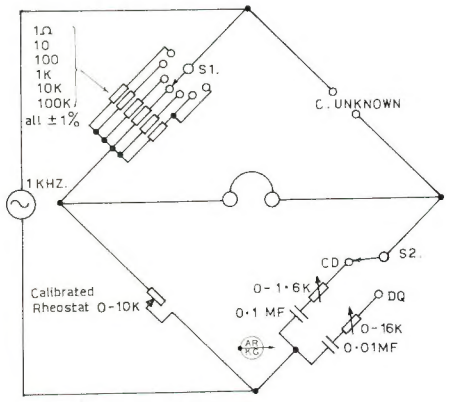

Fig. 10.

THE WHEATSTONE BRIDGE FOR MEASUREMENT OF INDUCTANCE

As the reactance of an inductor varies directly with the inductance, the Wheatstone Bridge can be used for the measurement of inductance in a similar manner as for resistance measurements, if a.c. is used instead of d.c., and an inductance standard is used in place of the resistance standard.

However, in practical bridges for inductance measurement it is not usual to use an inductance for the standard because an inductance may be influenced by external magnetic fields, also in most types of inductors variations in inductance occur as the applied voltage varies. Obviously such variations in inductance are undesirable in a standard.

Fortunately it is possible to use a capacitor in a bridge for the measurement of inductance if the position of the bridge arms are interchanged.

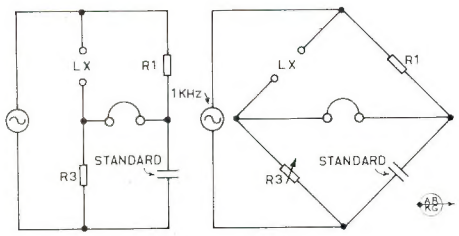

Fig. 11.

It will be noted that the standard reference capacitor and the unknown are in opposite arms (see Fig. 11), thus an increase in reactance in one arm is compensated by a decrease in the other opposite arm and the ratio of the two reactances is given by the ratio of the two resistance arms R1 and R3.

Just as it is impossible to make a capacitor which does not have any losses so it is impossible to make an inductance which does not have losses, therefore with such an inductance bridge as shown, it would be almost impossible to obtain a true null because of the differences in phase shift.

Fortunately adjustable resistances can be added to the arm having the standard so that losses can be added artificially to give the standard arm the same losses as appear in the "unknown" arm. Such resistances can be calibrated to give the energy factor or Q of the unknown inductor.

If such a resistance is connected in series with the standard condenser then the bridge is known as a Hay's Bridge and resistor can be calibrated to read values of Q in excess of 10.

For values of Q less than 10, a resistor is connected in parallel with the standard condenser and this circuit is known as a Maxwell's Bridge.

Two resistances will be required and fortunately one of the resistors used in the capacity bridge may be used for the Maxwell Bridge. The switch for these resistors may be marked LDQ and LQ.

In the LDQ position, the DQ resistor will have a useful range of 160 to 16,000 ohms, and dial controlling this resistor being calibrated 0 to 10. 0 equals 0 ohms, and 10 equals 16,000 ohms.

Now if the switch is in the LQ position, then a new variable resistor of 0-165 ohms is connected in series with the standard condenser to make the Hay Bridge. The dial for this resistor is calibrated 0 to 10.

The various bridges so far discussed can be made into a single instrument which will measure resistance from 0.01 ohm to 1 megohm; capacitance from 10 pF. to 100 μF.; with two ranges of power factor 0-0.1 and 0-1; and inductance from 10 microhenries to 100 henries, with two ranges of Q, 0-10 and 0-1,000 respectively.

The audio frequency must be 1,000 Hz.

The bridge just described is basically similar to the very popular General Radio type 650A Impedance Bridge.

As mentioned earlier, stray capacitance in the audio frequency source and the detector may prevent complete nulls being obtained. In professionally made bridges, specially balanced and shielded transformers are used between the audio frequency source and the bridge, also between the bridge and the detector to remove the effects of such stray capacities.

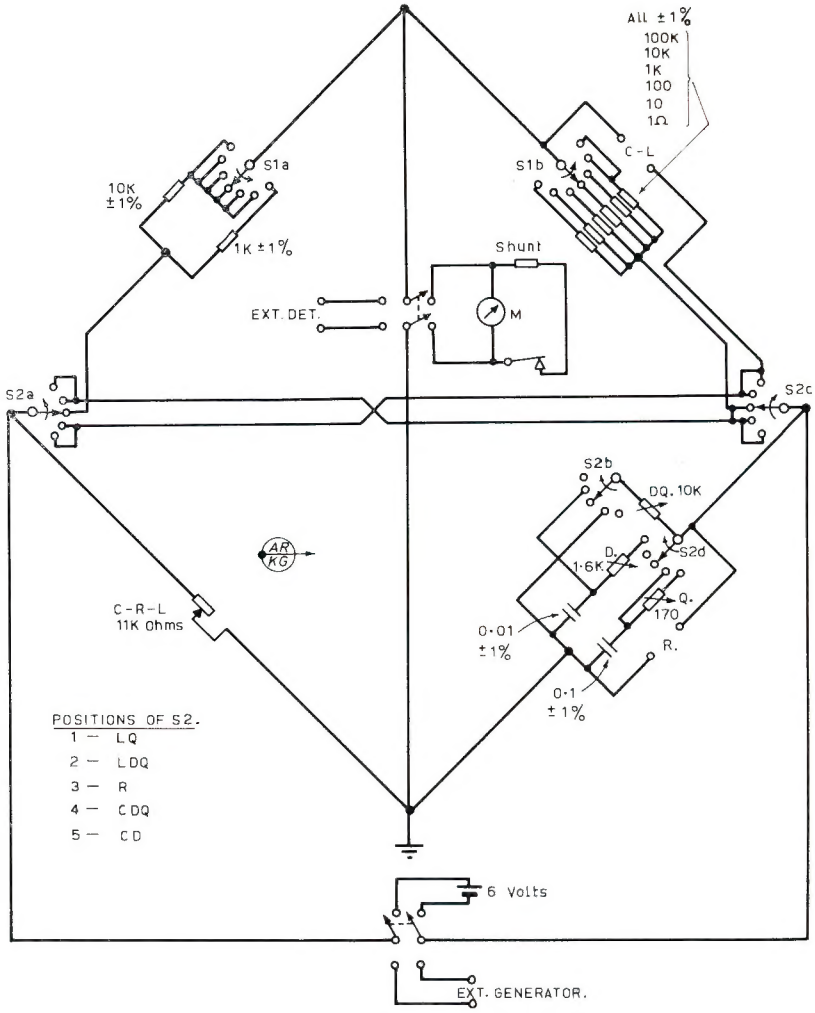

Fig. 12.

Wheatstone Bridges such as these described find considerable use in radio work and the student should become completely familiar with the theory and if possible practice of these bridges.

S1—2 pole, 7 position switch, 2 banks.
S2—4 pole, 5 position switch, 4 banks. Switches preferably ceramic.
All fixed resistances, high stability, ±1%.
C-R-L—0-10,000 or 0-11,000 ohms linear w.w. rheostat or potentiometer used as a rheostat. This should be the largest diameter it is possible to obtain. To be fitted with 6″ dial as described in the text.
D—0-1,600 ohms linear w.w. rheostat.
Q—0-170 ohms linear w.w. rheostat.
DQ—0-16,000 ohms linear w.w. rheostat.

If these values are not available, rheostats with slightly larger maximum values can be shunted with suitable fixed resistors to obtain the desired values.

TABLE 1

The seven positions of switch S1 (Fig. 12) should be marked as follows. These markings become the multiplying factors to be applied to the particular calibration marking of the C-R-L dial when a null has been obtained.

Sw. S1 Postn.	C	R	L
1	10 μF.	0.1 Ω	100 μH.
2	1 μF.	1 Ω	1 mH.
3	0.1 μF.	10 Ω	10 mH.
4	0.01 μF.	100 Ω	100 mH.
5	0.001 μF.	1,000 Ω	1 H.
6	0.0001 μF.	10,000 Ω	10 H.
7	—	100,000 Ω	—

Exampe.—Assume that when measuring some resistances that S1 is set to position 5 (marked 1,000 ohms) and that a null is found in the C-R-L dial at 7, then 7 × 1,000 = 7,000 ohms. If the null was found at 0.7 on the C-R-L dial, then the unknown resistance would be 700 ohms (0.7 × 1,000).

Caution.—Due to the tolerances of ±1% used in the fixed resistances it may be found that slightly different values may be obtained for the unknown resistor when adjacent switch positions are used, i.e. assume that the unknown is 1,000 ohms. With S1 on position 5, the C-R-L dial should read 1 (1,000 × 1 = 1,000). If S1 position 4 is used then a reading of 10 should be obtained on the C-R-L dial. 100 × 10 = 1,000, but due to the tolerances mentioned above, balance may not be the same although it will be close to it. Commercially manufactured bridges of this type can have accuracies of 1% for resistance and capacitance in the intermediate multiplier ranges and 2% for inductance. However, at the low and high multiplier ranges the accuracies may be only within 5% for resistance and capacitance and 15% for inductance.

Precision laboratory bridges will do much better than this and will be corresponding more expensive to manufacture.

TABLE 2

Calibration of the C-R-L dial for the C-R-L rheostat. The rheostat must be not less than 10,000 ohms at maximum resistance and should be not more than 11,000 ohms.

The overall accuracy of the bridge will depend on the accuracy with which the C-R-L rheostat can be calibrated. The dial should be at least 6″ in diameter and can be made from a piece of 1/8″ flat brass plate, turned to a 6″ diameter disc in a lathe, and fitted with a large skirt knob.

There are three ways of making the calibration. The first is to use a high quality ohmmeter. The second is to use another bridge, and the third method is to connect the rheostat in series with a 6 volt battery and an 0-1 mA. meter with shunts to 1 ampere. Measurements of the current flowing in the rheostat are made for various settings of the rheostat and the resistance calculated from Ohms Law.

As it may be difficult to determine the internal resistance of the battery, this should be ignored.

Calibration of the C-R-L Dial

Dial	Resist. of Rheostat in Ohms	Dial	Resist. of Rheostat in Ohms
0	0	1	1,000
0.1	100	2	2,000
0.2	200	3	3,000
0.3	300	4	4,000
0.4	400	5	5,000
0.5	500	6	6,000
0.6	600	7	7,000
0.7	700	8	8,000
0.8	800	9	9,000
0.9	900	10	10,000
		11	11,000

Intermediate points can be determined from this table.

This switch is marked as follows:

$D = R\omega C$	C		R	L		$Q = \frac{\omega L}{R}$
Dial	D	DQ		DQ	Q	Dial
Multiplier	0.01	0.1		1	100	Multiplier

The calibration for the D, Q and DQ rheostats can be determined in the formulae given earlier.

☆

ERRATA

"The Nature of Matter," Lecture No. 1, Jan. 1970, "A.R." The centre and right hand drawings on page 9 should each have a dot in the outer circle. Also, on page 10, the symbol for Lithium should be Li and for Silicon Si.

"Electric Current and Ohms Law," Lectures 2 and 3, Feb. "A.R.," page 10: In the working out of the example in col. 3, . . . + $\frac{R4}{1}$ should be . . . + $\frac{1}{R4}$

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S.W.R. Indicators—Trick or Treat?

COL HARVEY, VK1AU*

Over the years, experiments with Yagis and Quads have occasionally shown inconsistencies between **S.W.R. Bridge** readings and maximum radiation as shown by a **Field Strength Meter**. Although some of these effects can be blamed on feedline radiation, others remain unexplained other than as some inadequacy in the design or location of the s.w.r. meter. Discussion on the air shows that despite such anomalies (which few seem to be aware of) the s.w.r. meter is well regarded by many Amateurs and thought to be incapable of providing misleading information.

The following practical results show that the instrument can confuse and mislead, and that it might be wise to hedge one's bets on the infallibility of assumptions based primarily on s.w.r. readings.

Take the case of a three element plumber's delight on 21 MHz. built to A.R.R.L. formulae except that all elements were intentionally lengthened 5 inches. It was gamma fed, with the s.w.r. bridge at the transmitter end of a 66-foot length of co-ax. A frequency versus s.w.r. run gave the following results:—

21200 KHz.	S.W.R.	2.4
21300 ,,	,,	2.0
21400 ,,	,,	1.6
21500 ,,	,,	1.2

Table 1.

The inference one is entitled to make is that the s.w.r. would drop to a very low value outside the high end of the band, i.e. the array is too short. Let us now lengthen all elements 4 inches. A frequency versus s.w.r. run now gave the following result:—

21000 KHz.	S.W.R.	1.6
21200 ,,	,,	1.3
21300 ,,	,,	1.0
21350 ,,	,,	1.1
21400 ,,	,,	1.2
21500 ,,	,,	1.5

Table 2.

One would now conclude that the array is tuned and properly matched at 21300 KHz. But is it? Results show only fair forward gain, poor directivity and negligible front-to-back ratio. Despite this, the s.w.r. meter says that the array is just fine!

On the basis that a change in inter-element spacing to the optimum values for maximum forward gain might improve matters, and on the assumption that the element lengths were now fairly right, the reflector was moved slightly (to 0.25 wavelength spacing). Result:—

21000 KHz.	S.W.R.	3.2
21100 ,,	,,	3.0
21200 ,,	,,	2.9
21300 ,,	,,	2.6
21400 ,,	,,	2.3
21500 ,,	,,	1.8

Table 3.

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Could it be that a small change in inter-element spacing had so seriously detuned the beam that it was now resonating well outside the high edge of the band? Surely, with all elements already 9 inches longer than the formulae it couldn't possibly be true that another 7 or more inches was needed to bring the beam back into the band? If the s.w.r. meter indications were right, then the formulae were about 10% out—a fairly unlikely proposition. Something else must be wrong.

Perhaps the four half wavelengths feeder wasn't 75 ohms? Terminating the feeder with 52 ohms gave an s.w.r. of 1.4. Terminating with 75 ohms gave an s.w.r. of 1. The feeder was 75 ohms all right. At this point an interesting observation was made. If the s.w.r. bridge was set to the 52 ohm position and an s.w.r. versus frequency run repeated, instead of the result in Table 3, the readings became:—

21000 KHz.	S.W.R.	2.3
21100 ,,	,,	2.4
21200 ,,	,,	2.5
21300 ,,	,,	2.7
21400 ,,	,,	2.7
21500 ,,	,,	3.8

Table 4.

Compare Tables 3 and 4. Table 4 suggests that the beam is outside the low end of the band, Table 3 outside the high end! Obviously the shape of an s.w.r. curve doesn't necessarily indicate anything useful.

If anything is to be made of s.w.r. readings it is obviously imperative to start with an almost flat line of a known impedance. Measurements showed that the 66 ft. length of co-ax. was in good condition with only 2 db. loss (see A.R.R.L. Antenna Handbook, page 85). It gave a fair resonance dip on the g.d.o. at 21 MHz. (and a very good dip near 14 MHz.—presumably the free space resonant point of the outer shield). With 75 ohms at the far end, s.w.r. was 1:1.

Now to check out the balun. The traditional formula for a co-ax. balun is 462 ÷ F_{MHz} × Velocity Factor. Assuming 66% for the velocity factor, the length of the balun should be about 15 feet. However, at this length, the g.d.o. showed resonance well above 21 MHz., and it was necessary to add about 3 feet to the co-ax. to reach the correct length for 21 MHz.! Apparently the velocity factor of this particular cable was well above the traditional 66%. The evidence of the g.d.o. seems conclusive, as the observed dip moved smoothly from 26 MHz. to 21 MHz. as the length was increased.

The stage had now been reached where either 75 ohms at the end of the co-ax. feeder, or 300 ohms across the 4:1 balun resulted in an s.w.r. of 1:1. With the feed arrangements proven, the antenna was set up to the lengths required. Using the A.R.R.L. Antenna Handbook, it is possible to select the exact formulae appropriate to the inter-element spacing to be used. With an arbitrary setting on the gamma bars, the first s.w.r. run of the re-arranged array resulted in:—

21000 KHz.	S.W.R.	1.0
21100 ,,	,,	1.0
21200 ,,	,,	1.1
21300 ,,	,,	1.3
21400 ,,	,,	1.7
21500 ,,	,,	2.2

Table 5.

It was difficult to resist the temptation to shorten the antenna elements and so raise the frequency at which the s.w.r. would drop to 1:1. Instead, attention was directed only to the gamma match. The effect of two values of series capacitance was as follows:—

	Series Capacitor			
F KHz.	47 pF.		28 pF.	
21000	S.W.R.	1.1	S.W.R.	1.4
21100	,,	1.1	,,	1.4
21200	,,	1.1	,,	1.2
21300	,,	1.1	,,	1.1
21400	,,	1.3	,,	1.0
21500	,,	1.4	,,	1.0

The impedance bridge applied to the end of the co-ax. now showed a good non-reactive type dip at 21200, and read about 70 ohms. Best of all, on-the-air checks showed a significant improvement over the initial condition when despite a low s.w.r., the antenna element lengths were all wrong. According to one on-the-air report the half power points were plus and minus 20 degrees, and the front-to-back ratio 25 db. This is too good to be true, as 12 db. seems more likely.

The s.w.r. bridge is now left in circuit partly as an aid to tuning for maximum output, but mainly as a way

(Continued on Page 15)

Design Data for Short and Medium Length Yagi-Uda Arrays

INTRODUCTION

The Yagi-Uda array is a popular method of obtaining directional properties in an antenna. From a constructional viewpoint, particularly simple is the uniform array in which the directors are equally spaced and of the same length. Less simple is the solution to the equation which predicts what the performance of a given array is likely to be. The data presented here have been obtained using an I.B.M. 7090 computer to solve the performance equations for a range of geometrical parameters likely to be of practical significance.

THEORY

There are presently two ways in which the operation of Yagi-Uda arrays can be viewed. One view is to regard the radiation pattern as being the result of the interference between the radiation from the driven element and the travelling wave in the array; the analysis by this method for short arrays is very difficult.

The classical approach develops the radiation pattern from the interaction of the radiation from the driven element and a number of short circuited dipoles. It is easier to write down the equations describing the performance in this case. In fact, if Z is the mutual impedance between some given direction element and the driven element, I is the (complex) ratio of the currents between these two elements, and Y, X, W . . . are the mutual impedances between the chosen directors and each of the other parasitic elements, for this director—

$$Z = YI + XI + WI + \ldots$$

There are as many equations of this type as there are parasitic elements, and the whole set must be solved simultaneously. The mechanics of doing this is fairly standard computer work once expressions for the values of Z, Y, X, W . . . can be found.

PRESENTATION

All the data presented have been made non-dimensional with respect to wavelength, so figures for spacing, conductor diameter and element lengths are fractions of a wavelength. Reference to Table 1 shows that the following parameters are available:

No. of elements in the array:
3-10.

Spacing of elements:
0.15, 0.20, 0.25, 0.30.

Conductor diameter:
0.0025, 0.005, 0.01, 0.02.

Given any combination of these quantities, the entry in Table 1 gives the element lengths and resulting radiation pattern for maximum gain and a **purely resistive feed impedance.**

● The original of this article was a paper published in Electrical Engineering Transactions, Vol. EE2, No. 1, of March 1966. The precis we have below was prepared by Dr. D. R. Blackman, of Monash University. We extend our grateful thanks to the Author of the original paper, Mr. H. E. Green, M.E., of the Weapons Research Establishment, and to the Institution of Engineers, Sydney, publishers of Electrical Engineering Transactions, for their permission to publish this precis and associated tables.

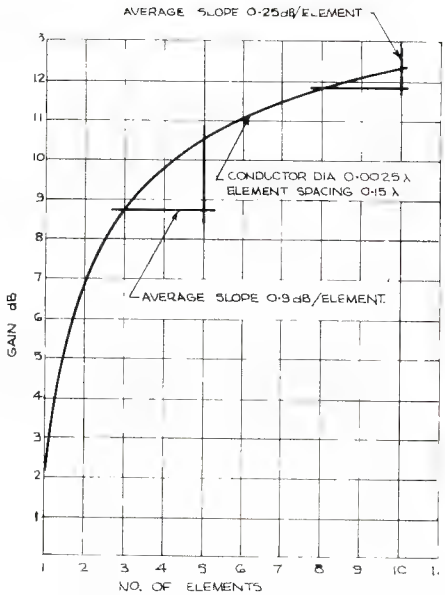


Fig. 1.—Typical Curve of Gain against Number of Elements for Uniform Yagi Array.

STACKED ARRAYS

As is to be expected, the benefit from each succeeding element added to an array decreases. A curve of Gain against Number of Elements is shown in Figure 1; this curve is characteristic of most arrays of the Yagi type. If more gain is wanted than can be obtained with, say, 5 elements, better performance can be more easily obtained by stacking arrays.

If the calculations leading to the results in Table 1 are not to be invalidated, sufficient distance must be left between arrays to preclude interaction between the elements in the separate arrays.

For arrays with the elements coplanar, a centre to centre spacing of not less than 0.75 wavelengths is suggested and for arrays with the elements parallel to spacing of not less than 1.0 wavelength.

PERFORMANCE OF ARRAYS DESIGNED USING TABLE 1

A number of experiments were performed to verify the predictions made in Table 1. The frequency used in these tests was 2.4 GHz. The agreement between theory and experiment was very satisfactory; for more details the reader is referred to the original paper. From a design point of view, these experimental antennae resonate at frequencies 1-2% below the calculated value. In practice, therefore, some slight trimming of elements may be necessary.

The same satisfactory agreement was not obtained with the predicted values of input impedance. The sensitivity of the input impedance of the Yagi is quite notorious, so this lack of close agreement is perhaps not surprising. Moderate mismatching appears to have little effect on the radiation pattern, and in practice the final matching would be made with the aid of a s.w.r. bridge anyway.

In the case when a metallic centre support is used some correction to the lengths of the elements is necessary. A suggested figure is to lengthen elements by 0.75 × diameter of the support; this will tend to give elements which are too long and may consequently need trimming.

Table 1 is shown on page 14 and is continued on page 15.

— . . . —

WORLD'S FIRST COLOUR T.V. TELEPHONE UNVEILED

The world's first colour t.v. telephone has been developed by Tokyo Shibaura Electric Company (Toshiba).

It will be displayed at Expo '70 by the Nippon Telegraph and Telephone Public Corporation.

The device consists of an ordinary telephone for conversation plus a 12" colour picture tube in the centre, with a television camera and a 3" black-and-white monitor tube arranged on it.

The moment the telephone receiver is lifted by the person called, the image of his bust appears on the 12" colour t.v. screen, while the caller can see his own image on the monitor screen.

If the self-view button is pressed, the called speaker's image is replaced with the caller's, enabling him to monitor his own image as viewed at the other end of the wire.

The trial-manufactured set is fairly large, says the Company, 52 centimeters high, 57 centimeters wide and 47 centimeters deep. But Toshiba claims that it can be reduced to about two-thirds by using integrated circuits and smaller picture tubes.

Design Data for Short and Medium Length Yagi-Uda Arrays (continued)

TABLE I.

Tabulation of the Characteristics of Uniform Yagi Arrays.

No. of elements	Spacing	Conductor diameter	Lengths: Reflector	Lengths: Driven element	Lengths: Directors	Gain (db.)	Front to back ratio (db.)	Resistance (ohms)	Polar diagram: H Plane: 3 db. BW	H Plane: 1st Null: Position	H Plane: 1st Null: Level	H Plane: 1st Side lobe: Position	H Plane: 1st Side lobe: Level	E Plane: 3 db. BW	E Plane: 1st Null: Position	E Plane: 1st Null: Level	E Plane: 1st Side lobe: Position	E Plane: 1st Side lobe: Level
3	0.15	0.0025	0.4931	0.4738	0.4764	9.4	7.8	3.1	68°	71.5°	12.1	96°	9.9	52°	90°	−40.0	116.5°	−22.0
	0.20		0.4883	0.4659	0.4693	9.8	6.7	7.8	68	70.5	19.2	99	11.0	52	89.5	−40.0	115	−23.0
	0.25		0.4812	0.4594	0.4597	9.5	5.7	18.1	72	74	40.0	99.5	−13.0	55	75.5	−40.0	81.5	−38.3
	0.30		0.4764	0.4543	0.4502	8.8	4.7	36.0	80	78	−17.1	98	13.4	58	90	40.0	115.5	−24.6
4	0.15		0.4883	0.4655	0.4597	9.7	8.3	19.2	71	74	−16.9	98	12.7	54	90	−40.0	112.5	−26.1
	0.20		0.5026	0.4765	0.4693	10.2	14.4	9.3	59	62	−10.9	83	9.5	48	90	−40.0	121	−22.2
	0.25		0.4907	0.4679	0.4621	11.2	13.5	13.5	56	57	−16.4	80.5	−10.4	46	60	23.3	67	−22.6
	0.30		0.4788	0.4585	0.4550	11.1	7.5	21.5	56	55	−40.0	78.5	9.9	46	55.5	40.0	69	−22.2
5	0.15		0.5074	0.4802	0.4621	10.2	16.7	14.1	64	66.5	−14.0	95	10.4	50	90	−40.0	122	−21.0
	0.20		0.4883	0.4664	0.4573	11.2	12.1	14.6	56	56	−15.2	77.5	−10.4	46	60	−21.7	64.5	−21.6
	0.25		0.4812	0.4579	0.4502	11.1	7.6	35.3	56	54	−40.0	77	9.5	46	54.5	−40.0	68	−21.2
	0.30		0.4835	0.4664	0.4573	12.2	18.6	21.2	46	45	−17.6	65	8.8	40	46	−21.5	59	−16.8
6	0.15		0.4955	0.4707	0.4526	11.0	15.7	13.7	58	59.5	−14.5	81.5	−11.1	48	90	−40.0	125	−24.6
	0.20		0.4835	0.4630	0.4454	11.3	8.8	35.4	55	54.5	−26.7	76.5	−10.2	46	55	−31.9	67.5	−21.8
	0.25		0.4859	0.4662	0.4526	12.3	17.4	21.5	46	46.5	−18.3	65.5	−9.3	42	47	22.4	59.5	−17.5
	0.30		0.4764	0.4560	0.4454	11.7	7.2	42.1	48	45	−27.4	64	−8.4	42	45	−31.8	59	−16.2
7	0.15		0.4859	0.4663	0.4454	11.4	9.3	22.5	54	54.5	−16.4	75	−10.5	46	56.5	−22.3	65	−21.3
	0.20		0.4931	0.4696	0.4502	12.1	21.1	19.9	48	47	−15.9	67	−9.2	42	48.5	−20.1	59.5	−17.5
	0.25		0.4788	0.4604	0.4431	12.1	8.5	40.5	46	45	−39.7	63.5	9.0	42	45	−40.0	59	−16.7
	0.30		0.4788	0.4611	0.4478	13.0	13.3	29.3	40	39	−24.1	56	8.6	37	39.5	−26.6	53	−14.5
8	0.15		0.4931	0.4794	0.4454	11.5	13.6	28.2	51	51	−16.4	72.5	9.0	44	52	−21.3	63.5	−19.1
	0.20		0.4859	0.4627	0.4407	12.4	11.2	29.3	46	45.5	−22.8	64	9.5	42	46	−26.5	59.5	−17.3
	0.25		0.4835	0.4637	0.4478	13.1	15.7	24.6	40	39	−17.4	55	−8.5	36	39	20.1	52	−14.1
	0.30		0.4812	0.4667	0.4526	13.2	30.4	26.6	34	33	−13.4	48	−7.2	32	33	−15.4	45	−11.3
9	0.15		0.4931	0.4715	0.4407	12.1	25.0	17.5	48	47.5	−16.0	67	−9.7	42	49.5	−20.4	60.5	−18.2
	0.20		0.4907	0.4721	0.4478	12.7	24.3	22.3	40	39.5	13.6	56	8.0	36	40.5	−16.5	52	−13.8
	0.25		0.4788	0.4628	0.4407	12.9	9.2	45.8	40	38	−27.3	54	−8.5	36	38	−29.3	51.5	−13.9
	0.30		0.4764	0.4579	0.4407	13.4	9.9	39.3	37	35	−35.1	49.5	−8.3	34	35	−36.0	47.5	−12.9
10	0.15		0.4907	0.4664	0.4335	12.5	13.4	22.9	46	46	19.5	64.5	−9.7	42	46.5	−23.2	59.5	−17.6
	0.20		0.4859	0.4648	0.4383	13.2	15.4	25.5	40	39.5	19.4	55.5	−9.0	37	40	−22.3	52.5	−14.8
	0.25		0.4812	0.4654	0.4407	13.7	20.0	29.2	37	35.5	−21.0	50	−8.7	34	36	−23.2	47.5	−13.4
	0.30		0.4788	0.4624	0.4454	14.1	18.8	31.1	32	31	−17.4	44	−7.7	30	31	−19.1	42.5	−11.3
3	0.15	0.0050	0.4912	0.4689	0.4723	9.4	7.6	2.9	68	70.5	−12.2	96	−9.8	52	90	−40.0	117	−22.0
	0.20		0.4865	0.4603	0.4629	9.8	7.2	7.9	69	72	19.0	99.5	−11.5	53	90	−40.0	115.5	−23.3
	0.25		0.4794	0.4530	0.4510	9.5	6.5	18.4	74	76	40.0	100.5	13.8	56	84	40.0	113	−25.9
	0.30		0.4747	0.4469	0.4416	8.7	5.1	35.7	81	78.5	−16.2	99	−13.0	59	89.5	−40.0	114.5	−24.9
4	0.15		0.4865	0.4593	0.4534	9.7	8.4	19.0	70	74	−17.1	98.5	−12.6	54	90	−40.0	115	−24.7
	0.20		0.5030	0.4741	0.4629	10.2	15.9	11.4	61	64.5	−12.3	88.5	−10.2	49	90	−40.0	123.5	−21.2
	0.25		0.4865	0.4626	0.4558	11.2	13.7	12.7	56	57	−16.0	79.5	−10.6	46	60.5	−22.8	66.5	−22.5
	0.30		0.4747	0.4530	0.4463	11.1	8.4	21.7	57	57	−40.0	79	−10.5	48	57	−40.0	69.5	−23.2
5	0.15		0.5054	0.4764	0.4558	10.2	17.0	13.3	64	67	13.8	94.5	10.6	50	90	−40.0	123	−21.0
	0.20		0.4865	0.4616	0.4487	11.2	13.3	14.7	56	57.5	16.2	79	−11.0	47	61	−23.1	66	−22.9
	0.25		0.4770	0.4514	0.4416	11.1	7.6	33.1	56	55	−37.9	77	−9.7	47	55	40.0	68.5	−21.4
	0.30		0.4817	0.4589	0.4510	12.2	15.4	18.4	44	44	−16.6	64.5	−8.5	40	45	−20.3	58	−16.1
6	0.15		0.4912	0.4652	0.4463	11.0	15.3	12.3	57	59	−13.5	78	−10.9	48	90	−40.0	126.5	−23.4
	0.20		0.4817	0.4565	0.4369	11.3	9.0	34.7	56	54	−27.4	76.5	10.1	46	55	−32.4	68	−21.7
	0.25		0.4841	0.4589	0.4463	12.3	15.0	19.4	46	45.5	−16.9	64.5	9.0	40	46	−20.8	58.5	−16.8
	0.30		0.4723	0.4487	0.4369	11.7	7.2	40.4	48	45	−27.4	64	−8.4	42	45	−31.9	59	−16.1
7	0.15		0.4865	0.4606	0.4322	11.4	11.2	20.5	56	56.5	−19.7	78	−11.2	47	58	−25.8	68	−23.4
	0.20		0.4888	0.4631	0.4440	12.1	19.0	17.3	46	46	−14.4	65	−9.0	40	47.5	−18.4	58	−16.8
	0.25		0.4770	0.4535	0.4345	12.1	8.8	40.2	46	45	−38.5	63.5	−8.9	42	45	−40.0	59	−16.5
	0.30		0.4747	0.4550	0.4392	13.0	13.6	28.3	40	40	24.6	56	−8.7	37	40	−27.3	53	−14.5
8	0.15		0.4936	0.4756	0.4392	11.5	15.1	23.4	50	50	15.0	71.5	−8.8	44	52	−19.8	62.5	−18.5
	0.20		0.4817	0.4565	0.4322	12.4	10.8	27.8	46	45	−22.0	63.5	−9.5	41	46	−25.5	59	−17.2
	0.25		0.4817	0.4576	0.4392	13.1	16.1	24.2	40	39	17.8	55.5	−8.5	36	39	−20.5	52	−14.2
	0.30		0.4794	0.4627	0.4440	13.2	26.0	29.3	34	33.5	14.6	48.5	−7.3	32	34	16.7	46	−11.7
9	0.15		0.4912	0.4663	0.4322	12.1	24.5	16.5	48	47.5	15.7	66.5	−9.7	42	49	−20.1	59.5	−18.1
	0.20		0.4888	0.4673	0.4392	12.7	23.8	22.0	40	39.5	13.9	56	−8.1	36	40	−16.8	52	−13.9
	0.25		0.4747	0.4557	0.4298	12.8	9.2	42.3	40	39	−31.5	54.5	−8.7	37	39	−33.8	51.5	−14.2
	0.30		0.4747	0.4507	0.4322	13.3	10.1	39.0	37	35	−35.3	49.5	−8.2	34	35	−36.2	47.5	−12.8
10	0.15		0.4865	0.4613	0.4227	12.5	13.5	20.7	46	46	−20.0	64.5	10.0	42	47	−23.7	60	−18.0
	0.20		0.4841	0.4581	0.4298	13.2	14.7	24.8	40	39	−18.8	55	−8.9	36	39	−21.4	52	−14.6
	0.25		0.4817	0.4559	0.4345	13.8	15.5	27.1	36	34	−17.2	48.5	8.1	33	34	−19.2	46.5	−12.4
	0.30		0.4770	0.4563	0.4369	14.0	18.8	30.5	32	31	17.4	43.5	−7.7	30	31	−19.1	42.5	−11.3
3	0.15	0.0100	0.4896	0.4624	0.4640	9.4	8.5	3.1	70	74.5	−12.1	96.5	−10.6	54	90	−40.0	117.5	−22.5
	0.20		0.4826	0.4518	0.4546	9.8	7.2	7.5	69	72	−19.0	99.5	11.5	53	90	−40.0	115	−23.4
	0.25		0.4733	0.4426	0.4430	9.5	5.9	16.5	72	74	−40.0	100	−13.0	55	76	−40.0	82	−38.7
	0.30		0.4663	0.4358	0.4313	8.7	4.7	32.2	79	77.5	16.9	98	−13.1	58	90	40.0	112.5	−25.6
4	0.15		0.4826	0.4510	0.4430	9.8	8.4	17.4	71	74.5	17.3	98.5	−12.7	54	90	40.0	114.5	−25.0
	0.20		0.4989	0.4685	0.4546	10.2	16.7	11.0	61	64.5	−12.4	88.5	−10.5	50	90	−40.0	126.5	−20.8
	0.25		0.4826	0.4530	0.4476	11.2	12.0	10.6	54	55.5	−15.1	78	−9.8	46	58.5	−21.4	64.5	−21.1
	0.30		0.4710	0.4424	0.4360	11.1	8.3	20.4	56	56	−40.0	79.5	−10.1	48	56.5	−40.0	69.5	−22.7
5	0.15		0.5036	0.4696	0.4476	10.2	16.8	11.1	63	66.5	−12.9	91.5	10.7	50	90	−40.0	123	−21.3
	0.20		0.4850	0.4529	0.4383	11.2	13.2	14.2	56	57.5	16.4	79	10.9	47	60.5	−23.2	66.5	−22.8
	0.25		0.4710	0.4419	0.4290	11.1	7.6	30.4	56	55	−40.0	77	−9.9	48	55	40.0	68	−21.7
	0.30		0.4756	0.4511	0.4407	12.2	16.8	18.1	44	45	−16.9	65	8.7	40	45.5	−20.6	58.5	−16.5
6	0.15		0.4896	0.4584	0.4337	11.0	16.5	12.1	58	60	14.5	80.5	−11.4	48	90	−40.0	127	−23.4
	0.20		0.4756	0.4485	0.4267	11.3	8.6	34.0	54	54	24.7	76	9.9	46	54	−29.5	67.5	−21.2
	0.25		0.4803	0.4495	0.4360	12.3	14.3	17.9	46	45	−16.5	64	−8.9	40	46	−20.3	58	−16.5
	0.30		0.4780	0.4636	0.4430	11.9	13.9	29.8	38	37	−12.0	55.5	−6.6	35	38	−14.6	50.5	−12.1

TABLE I.—*(contd.)*

No of elements	Spacing	Conductor diameter	Lengths			Gain (db.)	Front to back ratio (db.)	Resistance (ohms)	Polar diagram									
									H Plane					E Plane				
			Reflector	Driven element	Directors				3 db. BW	1st Null		1st Side lobe		3 db. BW	1st Null		1st Side lobe	
										Position	Level	Position	Level		Position	Level	Position	Level
7	0.15	0.0100	0.4826	0.4522	0.4197	11.4	11.1	19.4	56°	56.5°	−19.6	77.5°	−11.2	47°	58°	−25.6	68°	−23.2
	0.20		0.4873	0.4561	0.4313	12.1	20.9	17.4	47	47	−15.4	66	−9.3	42	48	−19.5	59.5	−17.4
	0.25		0.4710	0.4441	0.4220	12.1	8.6	37.7	46	45	−36.3	63	8.9	42	45	−38.9	59	−16.4
	0.30		0.4710	0.4432	0.4290	13.0	12.0	25.8	40	39	−22.2	55	8.4	36	39	24.7	52.2	−14.0
8	0.15		0.4943	0.4692	0.4290	11.5	16.3	20.2	50	49.5	−14.2	71	−8.7	44	52	−19.0	61	−18.0
	0.20		0.4780	0.4477	0.4173	12.4	11.4	25.7	46	46	−24.1	64	9.7	42	46	27.3	60	−17.5
	0.25		0.4780	0.4491	0.4267	13.1	16.9	23.2	40	39	−18.4	55.5	8.6	36	39.5	21.0	52.5	−14.3
	0.30		0.4756	0.4529	0.4337	13.2	28.1	25.3	34	33	−13.7	48	−7.2	32	33	−15.7	45.5	−11.3
9	0.15		0.4873	0.4593	0.4173	12.4	16.9	13.5	48	50	19.2	67.5	−11.8	42	51	−23.8	62	−20.7
	0.20		0.4873	0.4605	0.4267	12.7	23.0	21.9	40	40	−14.4	56.5	−8.2	37	40.5	−17.2	52.5	−14.1
	0.25		0.4686	0.4468	0.4173	12.9	9.1	41.2	40	38	28.0	54.5	8.5	36	38.5	−29.5	52	−14.0
	0.30		0.4663	0.4397	0.4197	13.4	9.4	35.7	36	35	29.2	49	8.2	34	31	−31.2	47.5	−12.6
10	0.15		0.4826	0.4527	0.4103	12.5	12.9	19.9	46	46	−18.9	64	9.8	42	46.5	−22.5	59	−17.6
	0.20		0.4803	0.4500	0.4150	13.2	15.5	23.4	40	40	−19.9	55.5	−9.1	37	40	−22.6	52.5	−14.8
	0.25		0.4756	0.4493	0.4197	13.7	18.4	26.6	36	35	−19.9	49.5	−8.5	34	35	−21.9	47.5	−13.0
	0.30		0.4710	0.4468	0.4243	14.2	18.3	28.0	32	31	16.8	44	−7.7	30	31	−18.4	42.5	−11.2
3	0.15	0.0200	0.4840	0.4502	0.4543	9.4	7.9	2.6	68	71	12.4	97	10.0	53	90	−40.0	116.5	−22.3
	0.20		0.4749	0.4384	0.4406	9.8	7.2	6.9	69	72	18.5	99	−11.6	54	90	−40.0	114.5	−23.8
	0.25		0.4657	0.4263	0.4269	9.5	6.0	15.0	73	74	39.9	100	12.9	56	76	−40.0	82	−38.8
	0.30		0.4566	0.4181	0.4132	8.7	4.6	28.9	79	77	−16.8	98	12.8	58	90	−40.0	113	−25.3
4	0.15		0.4771	0.4368	0.4269	9.8	8.6	16.0	70	74.5	−17.8	99	12.7	54	90	40.0	115	−24.8
	0.20		0.4977	0.4555	0.4429	10.3	15.3	7.8	59	62	−10.9	81.5	9.9	48	90	−40.0	124	−21.9
	0.25		0.4771	0.4411	0.4315	11.2	13.6	10.9	56	57	16.0	79.5	−10.5	46	60.5	−22.6	66	−22.3
	0.30		0.4612	0.4247	0.4201	11.1	7.4	17.4	56	55	40.0	78	−9.7	46	55.5	−40.0	68.5	−21.8
5	0.15		0.5023	0.4587	0.4338	10.2	16.5	9.3	62	66	12.4	89	10.7	50	90	−40.0	122.5	−21.7
	0.20		0.4794	0.4384	0.4224	11.2	12.6	12.6	56	56.5	16.0	78	10.6	46	60	22.5	66	−22.2
	0.25		0.4634	0.4252	0.4109	11.1	7.6	28.2	56	55	38.0	77	−9.7	48	55	−40.0	68	−21.3
	0.30		0.4680	0.4362	0.4246	12.2	15.6	15.7	44	44	16.5	64	8.6	40	45	−20.1	58	−16.1
6	0.15		0.4863	0.4459	0.4155	11.0	16.4	11.1	58	60	14.9	81	−11.4	48	90	−40.0	126	−23.9
	0.20		0.4680	0.4336	0.4064	11.3	8.7	30.4	54	54	25.4	76	10.0	46	54	−29.8	67.5	−21.3
	0.25		0.4726	0.4360	0.4178	12.3	14.9	16.5	46	45	−16.9	64	9.0	40	46	−20.6	58.5	−16.7
	0.30		0.4749	0.4430	0.4292	11.9	20.5	15.5	36	34.5	−9.4	51.5	−6.0	34	36	−11.7	46.5	−10.6
7	0.15		0.4771	0.4381	0.3995	11.4	11.1	17.9	56	56	−19.7	77.5	−11.1	47	57.5	−25.4	68	−23.0
	0.20		0.4817	0.4428	0.4132	12.2	20.2	15.5	46	46.5	15.1	65.5	9.3	42	48	−19.2	59	−17.2
	0.25		0.4612	0.4286	0.4018	12.1	8.5	34.3	46	45	32.9	63	−8.9	42	45	−36.0	59	−16.3
	0.30		0.4612	0.4290	0.4087	13.0	12.9	23.8	40	39	23.7	55.5	8.6	36	39	−25.9	53	−14.2
8	0.15		0.4886	0.4589	0.4109	11.5	16.7	17.1	50	49	13.9	70.5	−8.9	44	52.5	−18.6	60.5	−17.9
	0.20		0.4703	0.4325	0.3972	12.4	11.0	23.7	46	45	22.6	63.5	9.6	42	46	25.9	59.5	−17.2
	0.25		0.4703	0.4352	0.4064	13.1	17.3	21.3	40	39	−18.8	55.5	−8.7	36	40	−21.4	52.5	−14.4
	0.30		0.4657	0.4392	0.4155	13.2	29.9	22.9	34	33	13.4	47.5	−7.2	32	33.5	−15.3	45.5	−11.3
9	0.15		0.4840	0.4459	0.3995	12.2	22.7	13.9	48	47.5	15.4	66	−9.7	42	49	−19.6	59.5	−17.8
	0.20		0.4817	0.4491	0.4064	12.7	22.5	20.5	40	40	14.8	57	8.3	37	41	17.6	53	−14.2
	0.25		0.4612	0.4330	0.3972	12.9	9.3	38.5	40	38	26.7	54	−8.4	36	38	−28.4	51	−13.8
	0.30		0.4566	0.4237	0.3972	13.4	9.8	32.0	37	35	33.5	49.5	−8.3	34	35	−34.2	47.5	−12.7
10	0.15		0.4771	0.4393	0.3858	12.5	13.4	17.7	46	46	20.2	64.5	−10.0	42	47	−23.7	59.5	−17.9
	0.20		0.4726	0.4358	0.3927	13.2	15.4	21.0	40	40	19.9	55.5	−9.1	37	40	−22.5	52.5	14.8
	0.25		0.4680	0.4330	0.3995	13.8	17.5	23.2	36	34.5	17.9	48.5	8.3	33	35	−20.0	47	−12.6
	0.30		0.4657	0.4311	0.4041	14.2	18.1	25.8	32	31	16.9	44	7.7	30	31	−18.5	42	−11.2

S.W.R. INDICATORS

(Continued from Page 12)

of knowing if some mechanical fault has developed in the feeder. A short across the far end of the feeder will show only about 2:1.

GUIDE LINES

On the basis of this project, the following guide lines seem relevant:—

- **Element Spacing.** — Go for wide spacing, reflector at least 0.2 wavelength, director 0.25 wavelength. This can replace the 2 db. loss inherent in co-ax. feedline.
- **Driven Element.**—There is a great temptation to set it to resonance using a radiated signal and a diode meter combination across intended feed point. Don't do it! For gamma feed, the radiator needs to be a little short.
- **Reflector.**—Too much enthusiasm for front-to-back ratio will reduce forward gain slightly. But even the best front-to-back ratio will only cost you about 3 db. in forward gain. In VK it's usually best to go for maximum forward gain.
- **Gamma Bar.**—Increasing the spacing of the bar from the radiator raises the impedance range of the bar. Also, shortening the radiator will raise the antenna feed point impedance. Since a lot of work will be needed to optimise the options available, it's better to rely on the formulae for radiator length, fiddling only the gamma match for maximum radiated signal. Don't forget to provide some series capacity to offset the inductive reactance of the gamma bar.
- **Design Frequency.** — Design and tune up on a frequency 100 KHz. lower than the spot you wish to operate on most. The array will increase in frequency when raised above ground to its intended operating height.
- **Test Equipment.** — Use a simple Antenna Bridge, a G.D.O., and a remote indicating Field Strength Meter, initially. Rely on these, rather than a S.W.R. Bridge.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Manuscripts should preferably be typewritten but if handwritten please double space the writing. Drawings will be done by "A.R." staff.

Photographs will be returned if the sender's name and address is shown on the back of each photograph submitted.

Please address all articles to:

EDITOR "A.R.,"
P.O. BOX 36,
EAST MELBOURNE,
VICTORIA, 3002

The Wireless Institute of Australia—Federal Executive

REPORT TO FEDERAL COUNCIL (1970)

Gentlemen:

It is my pleasure to present the report on behalf of the Federal Executive on its activities subsequent to the 1969 Federal Convention. Whilst our financial year now ends on the 31st December, this report deals with the activities of the Federal Executive to date.

To present this report gives me particular pleasure for two reasons. Firstly, I believe that I can report to you that the last year has been one of the most successful and productive in the history of our Federal organisation. Secondly, successful year just passed is a fitting start for 1970, the year that marks the 60th anniversary of the Wireless Institute of Australia, and I have every reason to believe that 1970 will be a year more successful than the year just passed. In my mind there is no doubt that an active and effective organisation must continue to attract new members, and equally, our organisation cannot hope to be active and effective without the wholehearted support of the Australian Amateur population. I now turn to particular topics.

• 1969 N.Z.A.R.T. BI-CENTENARY CONFERENCE AT GISBORNE

The Federal Council resolved, at the 1969 Federal Convention, to accept the invitation of N.Z.A.R.T. to be represented at this most important Conference, and it was my privilege to represent you there. I was invited to address the Conference, which I did, on Saturday, 31st May. A copy of this address was reproduced in "Break-In", the official journal of N.Z.A.R.T., as well as in our own journal, "Amateur Radio". After my return on 20th June, 1969, I reported in detail to the Federal Council on this visit. The personal contact that this visit produced resulted in a frank and helpful exchange of views and, I believe, a far better understanding between the two organisations. More tangibly, it also resulted in the exchange of publications between N.Z.A.R.T. and the W.I.A. By February 1970 we were sending 83 copies of "Amateur Radio" to our New Zealand subscribers, N.Z.A.R.T. handling the subscriptions at a special rate for its members. The personal contacts initiated by this visit have continued, as I have been able to keep fairly regular "skeds" on 20 metres with the N.Z.A.R.T. President, Bill Hamer, ZL2CD. May I, in this report, once again record my deep appreciation for the hospitality and kindness that I received from the New Zealand Amateurs whilst I was in their country.

One matter that is to be raised at this Federal Convention is the possibility of altering the rules for the Remembrance Day Contest to enable the New Zealand Amateurs to participate. I believe that a favourable decision by the Federal Council on this matter would be very much appreciated by the New Zealand Amateurs, so many of whom expressed to me regret that they were unable to participate in this, the premier Contest in our part of the world. Their participation can only serve to bring our two Societies even closer together, which I believe is in the interests of both organisations.

• REPRESENTATION

At the 1969 Federal Convention, the Federal Council expressed the view that closer personal contact between the Federal Executive and the Divisions was desirable. I have taken every opportunity that has been open to me to pursue this policy, as I believe that without continuing personal contact our activities in the Federal sphere can be seen so easily as something remote and distant from our membership. In the course of my journey home from New Zealand, I met and conferred with the Federal Councillor of the New South Wales Division, and the President of the New South Wales Division. On Friday, 18th July, I attended a Council meeting of the South Australian Division in Adelaide, and on the following day I met a number of the members at the home of the Federal Councillor for that Division. On 4th October I attended and opened the joint Convention held in Albury by the adjacent Victorian and New South Wales Zones. On 17th October, in the course of a visit to Sydney, I conferred with the Council of the New South Wales Division, and on the following day conferred with the Federal Repeater Secretariat.

On Friday, 28th November, I addressed a General Meeting of the Queensland Division in Brisbane, and on the following Monday (1st December) I met the Council of that Division. On 4th March, 1970, I addressed a General Meeting of the Victorian Division. The total cost to the Institute of these visits to the Divisions has amounted to approximately $160. I believe that a continuing personal contact between the Executive and the Divisions throughout the year is of fundamental importance. It is too easy for the Federal Executive to be seen as seven faceless men, remote from the everyday life of Amateur Radio. What our Federal Organisation is doing is of basic importance to all Amateurs. Our Federal body represents all Amateurs everywhere, and an understanding of these activities can only come from personal contact.

In addition, I have now acquired a far deeper insight of the peculiar problems that face each Division that I have visited. I am quite convinced that many of the conflicts and misunderstandings of the past would have been avoided had personal contact been possible at those times. I believe that it is in the interest of our organisation for the future that this contact continues.

To the Federal Councillors, to the Presidents, to the Councils, and to the members of those Divisions that I was able to visit in the last year, may I express my appreciation of their hospitality, patience and courtesy.

• THE YEAR AHEAD

A considerable amount of time and effort has been devoted to planning for 1970. The Australian Tourist Commission provided, free of charge, 100,000 blank QSL cards for distribution to Australian Amateurs through the Divisions. That number, large as it was, was merely the start, for a further 112,000 cards were printed, using the plates prepared for the Australian Tourist Commission, the printing of which was paid for by individual members. To the Australian Tourist Commission, I extend our heartfelt thanks for their most generous gesture in providing so many Amateurs with such attractive cards.

The rules of the Cook Bi-Centenary Award were published in August "Amateur Radio", and a handsome Certificate has been produced and was featured on the front cover of the January "Amateur Radio". Copies of the rules of this Award were circulated to over seventy overseas societies and publications. A thousand copies of the Cook Bi-Centenary Award Certificate have been printed. It is our hope that the number of Certificates printed will prove to be quite insufficient and it seems that this is quite likely. In addition, from 1st January, 1970, to the end of 1970, Australian Amateurs are permitted to use the alternative prefix "AX", and the use of this prefix is an integral part of the rules of the Cook Bi-Centenary Award.

The success of the Award and the "AX" prefix became immediately obvious on 1st January, 1970. I think we have all been surprised at the very real interest that has been created—indeed I think it can be said that this Award has created more activity than any other single thing for many years.

The rules of the Cook Award have been the subject of some discussion. They have been tailored to provide an award attractive to overseas Amateurs. Various suggestions have been made to add specialised sections to the Award. Executive has accepted the advice of the Awards Manager that such sections would merely complicate the rules to serve a very small minority at the expense of sacrificing basic simplicity. A v.h.f. section does seem, however, to be required, though because of the diversity of views as to how the rules for such an award should be framed, the formulation of the rules for such an award has presented considerable difficulty. The matter has been left in the hands of the Federal Vice-President and the Awards Manager, and will be decided by Federal Council at the Federal Convention.

The role to be played by Divisions in 1970 is indeed important and once again I urge all Divisions to plan their activities for this year, bearing in mind the special significance of this year for Amateur Radio, particularly highlighting the 60th Anniversary of our organisation.

• CONFERENCE FOR SPACE TELECOMMUNICATIONS

As you know, a World Administrative Radio Communications Conference for Space Telecommunications has been set down to open in Geneva in June 1971. The significance of this Conference cannot be underestimated and on its own initiative, Federal Executive has prepared and circulated a confidential and comprehensive report to Federal Council. It will be the task of the 1970 Federal Convention to formulate the Institute's policy in relation to the 1971 Conference.

The report prepared by Federal Executive was the product of a week-end in November when various persons were consulted. In addition, a considerable body of material has been annexed to the report to assist the Federal Council in reaching a view. Federal Executive has suggested a policy for consideration by Federal Council as a tangible starting point in its considerations. This matter has occupied a very considerable part of the Executive's time during the past few months, sometimes to the detriment of other matters, but I think the importance of this Conference has more than justified the time that has been devoted to it. Whilst June 1971 may seem to be a long way in the future now, there is no alternative to early preparedness.

I would like to thank the Federal Councillors of those Divisions that submitted material, to the members of the Federal Executive who assisted in preparing the report, the Federal Repeater Secretariat, the W.I.A. Project Australis, and the very many other people who gave of their time to offer their views and expertise to the Executive.

• "AMATEUR RADIO"

Whilst the Institute's publications will be the subject of a separate report from the Editor, Mr. Ken Pincott (who is now a member of the Federal Executive), I would like to observe in passing, how many people have commented to me on the greatly improved standard that has been attained by our magazine during the past year. The additional funds obtained through the last price increase have been utilised to excellent advantage, and I am sure that all our members would join with me in expressing to Ken and to the Publications Committee our congratulations on a job well done.

It is gratifying to be able to report that for the first time this year, articles published in "Amateur Radio" are being reprinted by other journals, including "Radio Communication", "CQ Magazine" and the journal of the Dutch Amateur Radio Society.

"Amateur Radio" is the only direct means of communication the Executive has to our Australia-wide membership. I have attempted, in writing "Federal Comment", to deal with tangible subjects of current concern. I have never realised how hard it is to write "Federal Comment", though this year I suspect the task has been made a little easier because there have been so many topics eminently suitable for writing about. I have been heartened by the fact that so many people do, in fact, read "Federal Comment" and are prepared to express their views on the matters there raised.

• MEMBERSHIP

The following table has been compiled based on membership figures as at 30th December, 1969:—

	Total Licensees	Full Memb.	% Members as against Total Licensees	Assoc. Memb.	Total Memb.
VK2	1933	1061	55%	460	1521
VK3	1838	920	50%	276	1196
VK4 inc. VK9	694	350	51%	148	498
VK5 inc. VK8	748	410	55%	240	650
VK6	462	282	61%	88	370
VK7	229	146	64%	114	260
Totals	5904	3169	54%	1326	4495

Whilst it is to be expected that the smaller Divisions are able to attract a higher percentage of membership from their total licensees, the percentage of membership in Victoria and Queensland is disappointing. Certainly Queensland faces difficulties of immense distance and a population spread over a thousand miles. On the other hand, no such excuse is available to Victoria and I regard the Victorian figures as frankly disappointing. It is obvious that the New South Wales Division is considerably assisted by the large Associate membership and here again the Victorian figures compare unfavourably with the New South Wales figures.

Our total percentage of full members as against total licensees of 54% is obviously capable of improvement. On the other hand these figures compare favourably with most overseas societies. It is interesting to note, for example, that N.Z.A.R.T. attracts only a 49% membership. I can see no reason why we should not aim for a 60% membership and I commend this to the consideration of Divisional Councils.

• FEDERAL CONSTITUTION

Following the resolution of the Federal Council to change the financial year of the Institute to the calendar year to enable the easier preparation of accounts for the Federal Convention, the necessary amendment to the Federal Constitution was passed, all Divisions voting in favour of the amendment.

• PROPOSED NEW FEDERAL CONSTITUTION

As you will recall, the last outstanding matter that concerned the Divisions in relation to the Memorandum and Articles of Association of the proposed Federal Company, were those Articles making provision for a postal referenda of all members throughout Australia on the request of two Divisions, notwithstanding a decision of a majority of Divisions. For legal reasons, the inclusion of these provisions was impossible in Victoria, and Federal Council at the 1969 Convention resolved to ascertain whether a different attitude would be adopted by the appropriate authorities in New South Wales. I believe that the New South Wales Division has been advised that a similar attitude would be adopted in that State. The matter was left on the basis that the new Federal body would be incorporated omitting these provisions if this occurred. I have asked the New South Wales Division to define its attitude in the circumstances now existing and I am awaiting their reply. I am very hopeful that once the Constitution Committee of the New South Wales Division has considered the matter, incorporation will be able to be proceeded with without further delay. Then what is left to be done is of a machinery nature only and the speed of incorporation will be dependent entirely on how quickly the Divisions are able to formally execute the documents at a meeting of their Council.

The incorporation of the Federal Company, with the subsequent transfer of the Institute's publications to the Federal body will place, in the forthcoming year if it occurs, a heavy additional load on the Federal Executive. In particular, it will impose a heavy load on the Federal Treasurer and the Treasurer of the Victorian Division, as the arrangements that must be made will be largely of a technical accounting nature.

• I.T.U. FUND

The following amounts were to be contributed by each of the Divisions to establish this fund:

New South Wales	$2,600
Victoria	$1,600
Queensland	$950
South Australia	$1,100
Western Australia	$450
Tasmania	$400

At this time, a total of $6,738.97 is held in the fund with all of the Divisions except the New South Wales Division having attained their quota. Of its target of $2,600, the N.S.W. Division has paid to Federal Executive $1,659.

• I.A.R.U. REGION III.

During the year, the Interim Constitution of the I.A.R.U. Region III. Association was signed on behalf of Japanese Amateur Radio League, The Philippines Amateur Radio Association, the New Zealand Amateur Radio Transmitters, and the Wireless Institute of Australia, and thus this organisation came into formal being. No communications were received, however, from Robert W. Denniston, the President of I.A.R.U. The Region III. Association is the subject of a separate report from the Region III. Director, Mr. John Battrick, and apart from recording the achievement of our aim in formally creating an organisation within Region III., I leave this matter to his report.

• LIAISON WITH AUSTRALIAN POST OFFICE

Throughout this year, our relationships with the Central Administration of the Postmaster General's Department have been cordial in the extreme, and I would like to record the Federal Executive's appreciation of the assistance it has received from those officers responsible for the administration of the Amateur Service; in particular, Mr. E. J. Wilkinson, the Assistant Director-General (Radio), and Mr. Charles Carroll, who, until his retirement towards the end of 1969, was the Controller, Radio Branch. At the annual dinner of the Victorian Division, I presented Mr. Carroll with a handsome desk set to record the Institute's appreciation of his assistance during his years in office. I am sure that the close relationship that we enjoyed with Mr. Carroll will continue with his successor, Mr. Young, who was previously Superintendent Radio for New South Wales.

The retirement of Mr. Carroll resulted in some delays as Mr. Young did not take office in his new appointment until early this year.

One matter that has caused considerable concern is the question of repeaters. In 1968 an agreement was reached with the Department on this question, but the matter has been reviewed by the Central Administration. They have been reluctant to licence repeaters and have indeed been somewhat doubtful as to the basis on which they should be licensed. The Executive has continued to try and reach satisfactory finality on this matter and I am hopeful that this will soon be achieved. It is unfortunate that this has occurred as it has resulted in some rather unfair criticism of the Repeater Secretariat. We intend to confer with Mr. Young just prior to the Federal Convention and I am hopeful that we will be able to report further to the Federal Council then.

The question of metering points raised by the South Australian Division has been satisfactorily resolved, as have a number of other minor points.

I am also very pleased to report to you that the Department is very conscious of the hardship caused by the delays in the marking of examination papers for Amateur Proficiency Certificates and have streamlined their procedures. They have indicated that they are anxious to be advised of unreasonable delays and I am sure that every effort will be made to ensure that delays will be kept to a minimum.

Another matter that was successfully concluded was the Institute's suggestion that VK9 call signs should be allocated according to geographical area. Details of relevant arrangements have already been published.

The question of utilisation of W.I.C.E.N. organisations for other than emergency purposes was raised with the Department. The Department is adamant that activities such as the assistance of charitable organisations should not take place on Amateur bands.

Preparation for the World Administration Radio Communications Conference for Space Telecommunications, on which I have reported elsewhere, has involved a number of discussions with the Department. Under the present heading I would simply observe that the Assistant Director General (Radio) has indicated that it is his wish that the fullest possible consultation with the Amateur Service should take place. I believe that the sort of consultation contemplated is in the best interests of all concerned.

• ILLEGAL OPERATION

The 1969 Federal Convention discussed the apparently illegal operation by some persons in the 27 MHz. so-called "citizen band". During the year it appeared that this sort of operation was increasing instead of decreasing, and a conference was held with representatives of the Department early this year. Whilst these frequencies are not allocated to the Amateur Service, the identification of these larikins with Amateurs by the general public is a matter of legitimate concern. I believe that the Department will do all in its power to stamp out this sort of operation, which serves only to bring the law into ill repute and is causing friction amongst Amateurs.

• COMMITTEE TO ASSIST FEDERAL EXECUTIVE

At the 1969 Federal Convention the Federal Councillor for the N.S.W. Division indicated that his Division was anxious to render assistance in the Federal sphere. The Federal Executive considered this offer and suggested to that Division that a committee be formed to assist the Federal Executive by undertaking specific tasks referred to it by Federal Executive. The first task referred to this committee was item 2.6 of the 1969 Federal Convention relating to the specification of standards for solid state television receivers sold in Australia, with the view to the adoption of standards to determine the minimum susceptibility to cross modulation. The report and recommendations of this committee, comprised of members of the N.S.W. Division, will be circulated to Federal Council. I would like to thank those members of the N.S.W. Division who are giving their time to assist the Federal Executive in this manner.

The basis on which a permanent committee to assist the Federal Executive should be appointed has been discussed with the N.S.W. Division Council, it being suggested by Federal Executive that such a committee could be appointed on a basis similar to the appointment of the Federal Repeater Secretariat. However, I am advised that this matter is still receiving consideration. I believe that the basis suggested by Federal Executive is a proper basis as it recognises both the interests of the Division concerned and also recognises the Federal nature of such an activity.

I also believe that a permanent committee available to assist the Executive on specific tasks will be very useful and indeed the extension of this principle into other Divisions would seem to be worthwhile. From time to time opportunities arise where such committees can undertake specific tasks which both reduces the work load on the Executive and enables the involvement of more people in cur Federal sphere.

• W.I.A. PROJECT AUSTRALIS

During the year, to the Institute's great benefit, the Project Australis Group became an integral part of the Wireless Institute of Australia. I believe the loyal support of the members of this group has resulted in much favourable publicity for Amateur Radio generally after the successful launching of the Australis Oscar 5 satellite on 23rd January, 1970. It is unnecessary to report to you in detail now on the launch or the subsequent successful operation of the satellite, for this has been covered in detail elsewhere. It is, however, appropriate to mention the co-operation the Institute received from the Postmaster General's Department, the Overseas Telecommunications Commission, and the Australian Broadcasting Commission which enabled VK-2WI and VK3WI to broadcast the launch. Both broadcasts were highly effective and those responsible are to be congratulated.

In this report it is simply necessary for me to record our appreciation of the assistance and support we have received from the leaders of the group, in particular Mr. Richard Tonkin, Mr. Owen Mace and Mr. Les Jenkins.

It should be remembered that in accepting the group as a part of the Institute, we have also accepted a great responsibility for the future, for now the Federal Council must determine how the next satellite is to be financed. The plans for Australis-Oscar 6 are well in hand and the Federal Executive has made a grant of $200 of its funds to the group to enable the construction of a working prototype of the next satellite for presentation at this Convention.

One of the Amateur bands which would seem to be under considerable attack (at least in Australia) is the 420-450 MHz. allocation. The utilisation of these frequencies for sophisticated and useful experiments, such as Amateur satellites, is one of the best justifications for the retention of these frequencies. In any event, in my view, the fostering of this sort of activity—which is in the interests of Amateur Radio as a whole, is one of the inescapable responsibilities of our organisation.

• FED. REPEATER SECRETARIAT

During the year it became necessary to define with some precision the basis upon which the Federal Repeater Secretariat was appointed and in particular to define the relationship between the Division from which it was appointed and the Federal Executive.

As a result of my discussions with the N.S.W. Division on 17th November, 1969, the following duties of the Secretariat were defined:—

(a) To inform and advise Federal Council, through the Federal Executive, on all matters pertinent to the use of Repeater/Translator stations in the Amateur Service.

(b) To provide assistance for the Federal Executive in liaising with the P.M.G's Department Central Office on all matters referred to the committee.

(c) To recommend the use of specific frequencies within the authorised bands for such services.

(d) To formulate standards for the location, design and installation of such stations in order to simplify application by interested Amateurs to the licensing authorities for permission to use these facilities.

(e) To liaise with Divisional Repeater/Translator committees and advise on all matters related to the use of such Repeater/Translator Stations.

(f) To undertake such other tasks as are referred to it by Federal Council.

In addition, the following mechanics of the appointment of the Secretariat and the definition of its responsibilities were spelt out.

"Federal Executive shall call upon that Division to nominate members for the Secretariat, such members to be appointed by the Federal Executive annually. Federal Executive may re-constitute the Secretariat at any time at its discretion, or if requested to do so by the Division providing the members of the Secretariat. The Federal Executive will appoint a chairman of the Secretariat who may be appointed a co-opted member of the Executive in accordance with Clause 28 of the Federal Constitution."

Motions to this effect were passed by the Council of the N.S.W. Division and the Federal Executive. Mr. Tim Mills was appointed a co-opted officer and chairman of the Federal Repeater Secretariat. Mr. Ian McKenzie has remained a member of the Federal Repeater Secretariat. In October 1969, Mr. Chris Jones resigned so that he could become a member of the N.S.W. Division Repeater Committee and was replaced by Mr. John Rufus, VK2ZJQ. I would like to record the Executive's appreciation of Chris' enthusiasm and valuable work on the Federal Repeater Secretariat.

• V.H.F. PROGRESS

During the year progress has continued on the v.h.f. bands, and the following contacts are notable achievements in this part of the spectrum:

On 1296 MHz. VK2BDN worked VK2ZAC over a distance of 149 miles, a band record. On 576 MHz. VK5ZJL worked VK5QZ over a distance of almost 200 miles. On 432 MHz. VK3ATN worked VK7WF. On the 2 metre band, for the first time, the continent has been spanned each way, with VK3AOT, VK3AMK and VK3ATN, and possibly others, working VK6KJ in Albany.

• INTRUDER WATCH

The Federal Intruder Watch Co-ordinator, Dr. David Wardlaw, has devoted a considerable effort this year in attempting to create an active Intruder Watch organisation. As will be seen from his report, the response that has been received has been very poor indeed. This surprises me, as I would have thought that many active Amateurs would be prepared to assist in this activity, which I regard as being a very important aspect of our preservation of our frequencies. Nonetheless, the lack of response raises the question for Federal Council as to whether the continued effort in this regard is justified, for there seems to me to be little point in devoting a great deal of energy to an activity which is achieving very little.

• HOW TO BECOME A RADIO AMATEUR

At long last and after many delays, this is with the printers and we expect it to become available at the end of March. When it is available it will be distributed to the Divisions. This is one task that I am sure Executive is glad to see the end of. I am also sure that this publication will fill a long standing need.

• FEDERAL EXECUTIVE

Between April 1969 and February 1970, the Federal Executive held 13 meetings. The attendance at those meeting was as follows:

M. Owen	13	
P. Williams	12	
J. Battrick	1	(Resigned after Fed. Convention)
G. Pither	11	
D. Rankin	10	
D. Wardlaw	10	
A. Seedsman	4	(Resigned June 1969)
K. Connelly	3	(Resigned Nov. 1969)
W. Roper	4	(Appointed Nov. 1969)
K. Pincott	7	(Appointed June 1969)

• WORKLOAD OF FEDERAL EXECUTIVE

During the past year, the Federal Executive has become increasingly concerned at the inordinate workload that is borne by a limited number of people, in particular, by the Editor of "Amateur Radio" and by the Federal Secretary. As each year goes by, the responsibility borne by the Federal Executive is increased; even though the workload has been spread and the responsibilities shared as far as is practical, the workload imposed on the Federal Secretary is quite unreasonable. It is impossible to spread this workload indefinitely, without losing continuity, and in fact devoting more time to the instruction and co-ordination between the various persons undertaking the task. In my view, the need for a full time paid manager is no longer acute, but absolutely essential for the continued operation of our Federal body at its present level of activity.

So far as the magazine is concerned, it is not in the long term interests of our Organisation that it should be dependent on a person such as our present Editor, who is prepared to devote so many of his leisure hours to the management of the magazine, and here again, he is performing a task that must be performed by one person alone. This problem has reached critical proportions, as it is no longer fair nor reasonable to expect volunteers to make such great sacrifices of their time and energies. A paid manager must inevitably result in substantial subscription increases throughout Australia. The alternative is to simply abandon our Federal Organisation to the limbo of things to be done when time permits.

• CONCLUSION

In reviewing the activities of the past year, I am acutely conscious of all those many people to whom our thanks must be recorded. Because of business commitments, David Rankin has been able to devote less time to Institute activities than he would have wished. He has, however, carried out his responsibilities as Federal Activities Officer with his usual efficiency. In addition, as Federal Vice-President, I have much valued his advice and assistance during the year. David's experience and common sense have been of great personal assistance to me.

I have already referred to the enormous workload undertaken by the Federal Secretary. Peter Williams and I have been in almost constant communication throughout the year. I have discovered that the work of the Federal Secretary that is seen by the Federal Council is only the tip of the iceberg. Peter has devoted endless hours to the Institute, and if you agree with me that the past year has been successful, a substantial portion of the credit for that success must lie with him. Despite an ever increasing workload, Kevin Connelly carried on as Federal Treasurer until near the end of 1969 when the post was handed over to Mr. Bill Roper. Kevin never wanted to be Federal Treasurer—yet he undertook the task and has kept our books in order during the past year. We are delighted to be joined by Bill Roper, who brings with him both enthusiasm and experience.

I have already acknowledged the work of David Wardlaw as Intruder Watch Co-ordinator. David, through his experience, particularly in the United Kingdom, is a valuable member of the Executive, when discussing matters of an international nature, and I have valued his advice throughout the year.

During the year, Alf Seedsman resigned, and was replaced by Ken Pincott, the Editor of "Amateur Radio". On behalf of Executive and the Federal Council, I would like to extend our thanks to Alf for the work that he did for the Federal Executive during the years he served on it.

No more experienced or active member could be found than in Ken Pincott, and his presence on Federal Executive has brought the Executive's relationship with the Institute's publications much closer.

Geo Pither has undertaken a variety of tasks during the year and to him I extend my personal thanks for his unfailing support.

In acknowledging the assistance of the various people who have contributed to our Organisation during the past year, there is one person that I cannot overlook, namely, the former Federal President, Mr. Max Hull. I have personally much valued his guidance and advice during the year, and I have felt that I have always been able to call on him for assistance where necessary. In addition, the compilation of the Minutes of the 1969 Federal Convention, in itself a monumental task, was shared between Max and the Federal Secretary, Peter Williams.

When all seemed lost, so far as writing a history of the Institute for publication in "Amateur Radio" during 1970 was concerned, Max stepped into the breach and undertook the task. On reading the results of his research, I suspect that he did not realise the enormity of the task. To Max I express the thanks of the Federal Executive, and also my personal thanks.

Finally, though again on a personal note, I would also like to express my appreciation to each member of the Federal Council for his support during the year. As I stated at the outset of this report, I believe the year past has been successful beyond expectation. I believe that we may look forward to the future with some confidence, for I am sure that our Organisation will continue to grow and prosper, so long as it has the support of our members generally. This support is dependent upon the members knowing and accepting what we are about. This is in turn dependent on all our members being constantly informed on those matters that are of a Federal concern. One great difficulty that faces the Federal Executive is that so many matters that involve expenditure of considerable times are not either capable of, or suitable for, reporting in detail. The continued support of the Federal Councillors and through them, the Divisional Councils, is essential.

Because, at a national level, our organisation is a Federation, and therefore necessarily complex, the risk of remoteness is very real. We cannot afford to be remote—we need the support of every Amateur in Australia.

I believe we can justify that support.

Michael J. Owen,
Federal President, W.I.A.

— . . . —

HELP WANTED

The Publications Committee is in urgent need of extra manpower. Our present Secretary (Bill Roper) has joined Federal Executive as Treasurer, and wishes to relinquish his position with this Committee. This job entails two or three evenings per month, depending on how much work results from our monthly meetings. Although not necessary, it would be convenient if a replacement could be found who resides in one of the eastern suburbs of Melbourne.

We are also seeking somebody to assist with magazine and book reviews. Syd Clark does the job now and it is becoming a bit too much for one man to read them all and do the review. Syd would prefer that his assistant live in the Heidelberg-Rosanna area.

Amongst the overseas magazines we receive are the journals of our kindred Societies in Italy, Spain, Belgium, France, Germany, Holland, Norway, Sweden and South Africa. We will be happy to make these available to anybody who can read these languages if in return they will do a brief review of the contents for us.

Interested persons are asked to contact the Administrative Secretary of the Victorian Division, W.I.A., 478 Victoria Parade, East Melbourne, or phone 41-3535 and indicate in what way they can assist us. Mrs. Bellairs will pass the details on to the committee member concerned, who will in turn contact you.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Again we have had a very profitable month, due to rather good conditions, and a couple of more than interesting expeditions. TI9CI from Cocos Is. was the first to appear, and despite evident problems with the rain, it would seem that they had a successful operation. They were due to come on the air from Seranna Bank on the return journey, but from comments by some of the DX gang, they had not appeared by Feb. 26. QSLs for the operation go to TI2CMF with SAE plus IRC's.

The second operation of interest this month was the long awaited visit to Qatar from Feb. 21 to Feb. 27. I did not hear them, however from comments on the air it would seem that the operation was a success. The QSL information is shown in Geoff Watts DX News Sheet as K4MQG for the W/VE chaps only, and in their case a SASE is a must for the W Bureau will not be used, however for the rest of the world, the QSLs are to go direct to MP4BHH, Box 155, Manama, Bahrain Is., with SAE and the usual IRC. This has been a costly trip so I believe, and the SAE will keep costs down.

FO8CY has been QRV from Nukuhiva, Marquesas Is. since Jan. 18. Jean is the operator and he has been reported here quite frequently. I assume it only counts as French Oceania in our lists, however the actual locale is around 140 deg. west and near enough to 8 south of the equator. FO8AA will make a visit there later this year.

GM3FSV/A and GM3OGJ/A operation on Feb. 6/8 was from Kinross and is of particular interest through being the most difficult of the Counties to work.

Egypt is not in the Amateur Radio news very often these days, but there is regular activity from that country, the latest of interest being "Moty" SU1MA, who is now on SSB usually around 14200 and has been noted in this country at around 1700z. QTH is Box 840, Cairo.

For the Island hunters, there is regular activity from the Marianas by KG6SM whose manager is W2CTN, and KG6SY whose cards go direct to him at Box 209L, Capital Hill, Saipan, Mariana Is.

An enquiry or two this month from chaps who have heard the RA prefixes on 10 mx. RA3AZY 9CBK and 5ICC are three mentioned by Geoff Watts as active, and they are all Russian VHF stations, operating on 10 metres and above. Likewise the UK prefixes are also Russians.

From the VP areas there has been quite a host of stations, VP2MY is QRV from Monserrat until March 1, QSL to his home address WB2EBG. VP2LX from St. Lucia, QSL to G3FGP. VP2KM "Ken" from St. Kitts, QSL to VE3EUU. VP5GM on Caicos until April then home as G3WOV where his QSLs should be sent. VP5TH "Tom" also on Caicos, says QSL to WA5GFS. Finally, VP8JT from the Antarctica is on 80 metres quite regularly at around 0400z, which is of little use to us here, but he is on other frequencies as well, and his manager VE1ASJ provides a rapid QSL return.

VU2ITU and VU0ITU were in operation from Jan. 21 to Feb. 11 from C.C.I.R. Conference in New Delhi. All QSLs to 4U1ITU, International Amateur Radio Club, I.T.U., Geneva 20.

The activity around the New Zealand area still continues. Barry ZM1BN/A due to return home at the time of writing and the country status of this one is still to be thrashed out. It is over the required 240 miles from the point of administration. ZM3PO/C still active, and his manager George ZL2AFZ has a new batch of cards for him. On the Kermadecs, Roy ZM1AAT/K still continues, and he now listens daily on 51.50. Several VK/ZL stations have been heard but to date none have been worked. His listening time on this band is 0900z.

ZK1MN has been active from Manihiki since Jan. 28 on 80 metres CW only, but expects to have SSB gear operative on all bands by April. ZK1AJ continues from Raratonga.

Harold AX0LD gets on the air when the opportunity arises, but expects to uplift his activity soon. His manager ZM2AFZ has a sked with him 2200z Sundays on 14150, and they will be pleased to stand-by for anybody needing Macquarie.

ZD9BN on Gough Is. has the following skeds, with ZD9BM joining in on occasions from Tristan da Cunha. On Monday, Wednesday and Friday, 1030 to 1200, and 1500 to 1800z. Tuesday, Thursday and Saturday, 1030 to 1100, 1545 to 1800, and 2300 to 0100z. His frequencies are 3.5, 7.1, 14200 to 14150, and 14250 to 270. He is looking for contacts in this part of the world.

Another looking for ZL contacts in particular is Archie ZD5R, who is active on all five bands and QSLs via his QTH, Box 99, Mbabane, Swaziland. Other activity from there is by ZD5M, mainly on 10 metre CW, ZD5B mostly 20 SSB, ZD5X is on CW only but on all bands, whilst ZD5T and ZD5V are active on very rare occasions

ZS2MI is well under way with his SSB operation from Marion Island and was causing the big pile-ups for some days. He expects to be on 15 with this mode shortly. QSL to ZS6LW. One report says he moves 5 KHz. up after each QSO, and listens 240 to 250.

The call ZD9BP was issued to Andy HP9FC/MM who visited Tristan da Cunha late in Jan. whilst the research vessel Vema was in Tristan waters. QSL to VE1ASJ.

5H3KJ/A and 5H3LV/A were due to come on from Latham Is. on Feb. 28 to Mar. 2. The location of this one is 6.55 south, 56 east, operation mainly on 15 and 20 metres. QSLs for the former to W7VRO, the late to VE3ODX.

KC4USP from Palmer Arch says QSL to K2BPP; KC6YA on from Yap Is., QSL to R. Garman, Box 185, Yap Is., West Carolines; and KS6DH from American Samoa often on 3507 CW at about 1200z, says QSL him to the Dept. of Education, Pago Pago.

We are always non commital about operation from Albania, however once again the rumours are too persistent to ignore. DL7FT and DJ7VY plan operation from that part of the world from May 15 to May 22; if not, it will be during the two weeks following Sept. 19. This particular jaunt is in the planning and "collecting" stage, and will be held unless there is any further "political delay".

CR8AI, still very active, again makes the request re his QSLs that they go to him, Luis A. Rodriquez Fernandes, Box 60, Dili, Portuguese Timor, endorsed VIA Darwin, Aust. They arrive via Indonesia in poor condition, often minus contents.

FK8BO operation Feb. 12 to 14 by ex-TT8AM counts only as FK8 for D.X.C.C., but separate for D.U.F. award. His QSLs to Thomas Savelli, Box 28, Noumea, New Caledonia.

KZ5NR is at his new location for the next two years, using an inverted Vee on 40 and 80, with a three el. beam on the other bands. His operations include 3505 or 3805, 0300 to 0500, 7505 or 7205 from 0100-0400. QSL to WA9PZU.

Activity has been reported from the Sudan, when ST2SA worked into the U.S.A. on 3507 at 0400z. He is Dr. Sid Ahmed Abrahim, Box 125, Mendai Hospital, Sudan.

Tim SV0WY is active from Levkas in the Ionian Is. and should be there for a year. He will shortly have a SB200 into a Quad, but for the present is most likely to be found around 14015 CW. QSL to SV0 Bureau.

Activity continues from French Somaliland, with FL8MB on 14208 working from a list prepared by 7Z3AB, also FL8RC often on 15 CW, the latter's address being Claude Ribouti, B.P. 372, Djibouti, TFAI.

Our VK3 QSL Manager, Eric Trebilcock, advises that WB2UKP is QSL Manager for BV2A only for QSOs made after 1st Nov., 1968, all prior to that go direct to BV2A. Also Eric says that all QSLs for VK9RY go to the VK9 Bureau and not to VK3. Finally, ex-VK3AAM cards go to G6XJ. Eric continues to amaze me with his activity. The list of DX he has logged is fantastic, yet he continues to cope with the VK3 Bureau and sundry other activity as well.

Of possible interest, some of the DX heard here is G3IFF/MM in the South China Sea; IT1JT on 20 SSB says QSL to Box 66, Catania, Sicily; Mac ZS1LK, with a fantastic signal on 20 SSB at around 2000z, says QSL to Box 443, Somerset West, South Africa. KR6RH coming in 559 on 80 metres a few nights ago at 1000z with no takers. Ed JW7UH operating from Spitzbergen Is. W3USS, whilst not DX, is of special interest, he operates from the U.S. Senate and issues a very attractive certificate for the QSO. He goes to ARS W3USS, U.S. Senate, Washington, 20510, D.C., U.S.A. The African stations have been pouring in here at around 1900z on 20 metres, particularly from ZE and ZS. Noted 9X5AA, Leo Cyr, B.P. 28, Kigali, with a 40 db. over 9 signal a couple of weeks ago. Leo can be reached via the I.S.W.L. also.

NEW PREFIXES

CW was a special prefix used by the Uruguayan stations during last year's "CQ" Contest. JR is the series being issued to newly licensed stations in Japan. OI was a special issue to a Finland station for the last Scout Jamboree. 9I5 was used by Zambia to commemorate their 5th year of independence. CS and CU were to be used by the CT1 gang during the last "CQ" W.W. Contest.

AWARDS

Rome Centenary Award. For working Rome stations in 1970. VK stations, in fact all countries other than Europe, need 8 points, each QSO counting as one point except for those made on Sept. 30, which count as three points. GCR list plus 8 I.R.C's to A.R.I., Box 361, Rome, Italy, by Mar. 31, 1971. Available to S.w.l's also.

ZM Award. There has been quite a lot of enquiries coming to me as to whether this award is available to S.w.l's. In actual fact it is and Charles Thorpe of VK4 was amongst the earliest recipients.

Mayflower Award. To commemorate the 350th anniversary of the sailing from Plymouth of the Pilgrim Fathers for America. All profit from this award goes to the fund for providing Amateur Radio equipment for the Cheshire Homes. Overseas stations need to work five stations in the city of Plymouth, all QSLs from Jan. 1 this year. Also available to S.w.l's, the cost being 8/6 sterling, made payable to C.H.A.R.N. Fund, and sent with application and check list to G3VUC, Fillace Park, Horrabridge, Yelverton, Devon, PL20-7TE, England.

South American Award.—This award requires QSLs from CE, CP, CX, FY, HC, HK, LU, OA, PY, PZ, YV, ZP and 8R. The application, together with QSLs plus one dollar U.S. to HC1TH, Box 583, Quito, Ecuador.

The Laen W Award is issued by the S.W.L. Club Activity of Idkerberget, Sweden, for working a number of stations in Laen W Providence of Dalecarlia, Sweden. The requirements as far as we are concerned are Class A 15 stations, Class B 10 stations, Class C 6 stations, and Class D 3 stations, have to be worked after Aug. 15, 1967, on any band or mode. Fee is one dollar or 10 IRCs for the basic award, seals for higher classes need two more IRCs. Applications to Awards Manager, Box 209, S-780 24 Idkerberget, Sweden. To SWLs on a heard basis also.

Manitoba Centenary Award.—Five points per VE4 station per band per mode using 1970 QSOs only. 100 points needed, cost is two IRCs and the manager is VE4JK.

L.A.C.A. Award.—This is quite a simple one, which you can obtain from Boys Life Radio Club Awards, C/o. Certificate Dept. of Boy Scouts of America, New Brunswick, N.J., 08900, N.J., U.S.A. All you need is one card from each U.S. call area one to zero, no charge and is available to SWLs also.

On the subject of Awards, quite often one comes along which we don't happen to hear about, so if you happen to come across any of particular interest, I would be pleased to have the details, also their availability to SWLs.

CONGRATULATIONS

Whilst this item has no direct bearing on the purpose of this page, that is to provide DX information, it will be of interest to many Amateurs and SWLs alike. Many of us started to have an interest in Radio through the excellent articles written by Art Cushen in the earlier days of the magazine "Electronics Australia". Art is totally sightless, but despite his handicap, he has worked hard to assist others in the radio field, and has spent much time doing welfare work for the blind. For his services to radio, broadcasting, journalism and blind welfare, Art was awarded the M.B.E. in the New Year's honour list, and I would like to add a word of congratulations to him on behalf of the many W.I.A. members who got a start in the hobby through his efforts.

On the subject of the aforementioned magazine, recently I had cause to reply to one of their queries from a newcomer to the radio fraternity on the subject of identifications for SWLs. My reply received a full "appearance" in one of their feature columns, and shortly after its release I was inundated with letters from young and not so young chaps who wanted to know more about the various aspects of Amateur Radio. These chaps were from a group outside the reach of the Y.R.S. and Radio Clubs, and I have done my best to assist them, however there is apparently a vast untapped reservoir of interested persons who could be recruited. I will be following up this lead at once, but I would like to hear from any club officials anywhere who are prepared to assist any enquiries to whom I may direct them. Judging by the lack of activity on the DX bands, despite the AX prefix, we should follow hotly on the trail of any chance we have to add to our numbers.

MORE QTHs

3V8AL—Fred Powell, A.I.D. Mission, U.S. Embassy, Tunis, Tunisia.
5A1TK—Box 3363, Tripoli, Libya.
5A4TE—Box 6327, Tripoli.
5B4ES Amateur Radio Club, The English School, Nicosia.
5L2F—C/o. Radio Station ELWA, Monrovia, Liberia.

(Continued on Page 24)

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"HAM RADIO"

November 1969—

What's this we hear about Op. Amps. by WB2EGZ. The title just about describes the author's intentions. Describes Operational Amplifiers, what they do and how they are used. 17 plus pages text, photos and diagrams.

A Fixed Tuned Receiver for WWV, W6GXN. A relatively simple transistor/IC circuit for reception of WWV on your favourite frequency 15 MHz.

A Multiband Long-Wire Antenna, W3FQJ. Some 300 feet all told. No traps, some jumpers.

One More Electronic Keyer, VE7BFK. ICs and other solid state components in a solid constructional article.

Antennas and Capture Area, K6MIO. Some theory you may not have seen elsewhere.

Increased Sideband Suppression for the HT37, W3CM. None of 'em are perfect. If you own one this could be for you.

A Low Cost Amateur Microwave Antenna, K6HIJ. Gain is stated to be 24 db. at 3335 MHz.

A Tone Modulated Signal Generator for Two and Six Metres, WA8OIK. Crystal locked, too. Solid state two transistor.

Big Beam for Six Metres, W4ERO. Colinear.

Repair Bench. Tuning Up SSB Transmitters. The good oil.

October 1969—

Hot Carrier Diode Converter for Two Metres, K8CJU. Something new and complete instructions, too.

A Practical Discussion on Product Detector Operation, VE3GFN. One for all the sidebanders.

Hot Carrier Diode Noise Blanker, W4KE. HP's baby seems to be finding its way into more and more equipment. HP even have light emitting diodes at $5 or $6 plus tax.

Low Cost Integrated Circuit for Amateur Equipment, WA7KRE. Simple new consumer ICs should appeal to the home builder who is looking for superior performance with less complexity.

Improving the F.M. Repeater Transmitter for Amateur Use, W6GDO. These simple modifications increase circuit Q and provide improved performance through lower receiver de-sensitisation.

Construction of High Frequency Diversity Antennas, W2WLR. Complete details on building new designs described previously in "H.R." magazine. (There are three varieties of diversity operation: space diversity, frequency diversity and polarisation diversity.—Ed.)

Solid State Exciter for 432 MHz., W1OOP. Here's a solid state exciter that converts 20 mW. of two metre drive to 32 watts on 432 MHz.

Calculated Received Power in a Radio Communications Link, W1EZT. A detailed analysis of just what happens to the hard-earned watts from your transmitter.

An Automatic Two-Way DX Beacon for VHF, KV4FU, K6EDX. Simple method of ensuring that you will be there during band openings.

High Linearity Voltage Controlled Crystal Oscillator, WB6IOM.

"HAM TIPS"

This month I have for review a number of issues of R.C.A. Ham Tips kindly supplied by A.W.A. Ltd.

Vol. 26, No. 3: **RF "Sample Box" for 'Scope Monitoring of Amateur Transmitter Output,** by W2GQK.

Vol. 26 No. 4: **A Solid State AM Transmitter for Two Metre Operation,** WB2EGZ.

Vol. 27, No. 2: **A VFO Calibrator,** W2YM.

Vol. 27 No. 3: **Using the MOSFET as a Product Detector and AGC Gate,** W3KDT.

Vol. 28 No. 1: **R.C.A. Silicon Power Plastic Transistors in a Regulated DC-to-DC Converter,** WB2EGZ.

Vol. 28 No. 2: **An Audio Control System for SSB,** W2YM.

"RADIO COMMUNICATION"

December 1969—

The Integrated Circuit Approach to AGC, G3PDM. Some very interesting ideas. Good for those with access to a transistor farm.

The G8ARV Two Watt Two Metre Transistor Transmitter, G8ARV, G6SDB/T. Diagrams and pictures.

Technical Topics, G3VA. G3PDM high stability FET Vackar oscillator, continuously variable bandwidth filters, monitoring drive voltages, active car radio aerial. (Will the man who rang me at the office please call again.)

Aerials and Planning Permission, G3JAG. Could help some VKs.

A Bistable for Relay Control, G3XGP.

Band Pass Filters, G6JP.

Reflections on a Bridge, G8ON. The SWR bridge is not an "island".

Changing to Metric in the U.K., E. Chicken, M.I.E.R.E. The differences between the Metric and Imperial systems are discussed and the Metric system is shown to have numerous advantages. This will be of interest to Australian Amateurs also because Australia is also committed to "metrication" in the long term. With the change to Metric measure will come many alterations in dimensions of various products. For instance the familiar ¼ inch tuning shaft, which is about 6.25 mm., will become 6 mm., some 0.010 inch smaller.

"RADIO ZS"

November 1969—

Portable Extending Radio Mast, ZS6ET. Five sections of square section tubing 18 s.w.g. (0.044 inch) which telescope one into the other. Top section is ½ inch. The whole ends up about 24 ft. tall with two sets of nylon or similar guys. 17 s.w.g. tubing will telescope if bought in 1/8 inch rises.

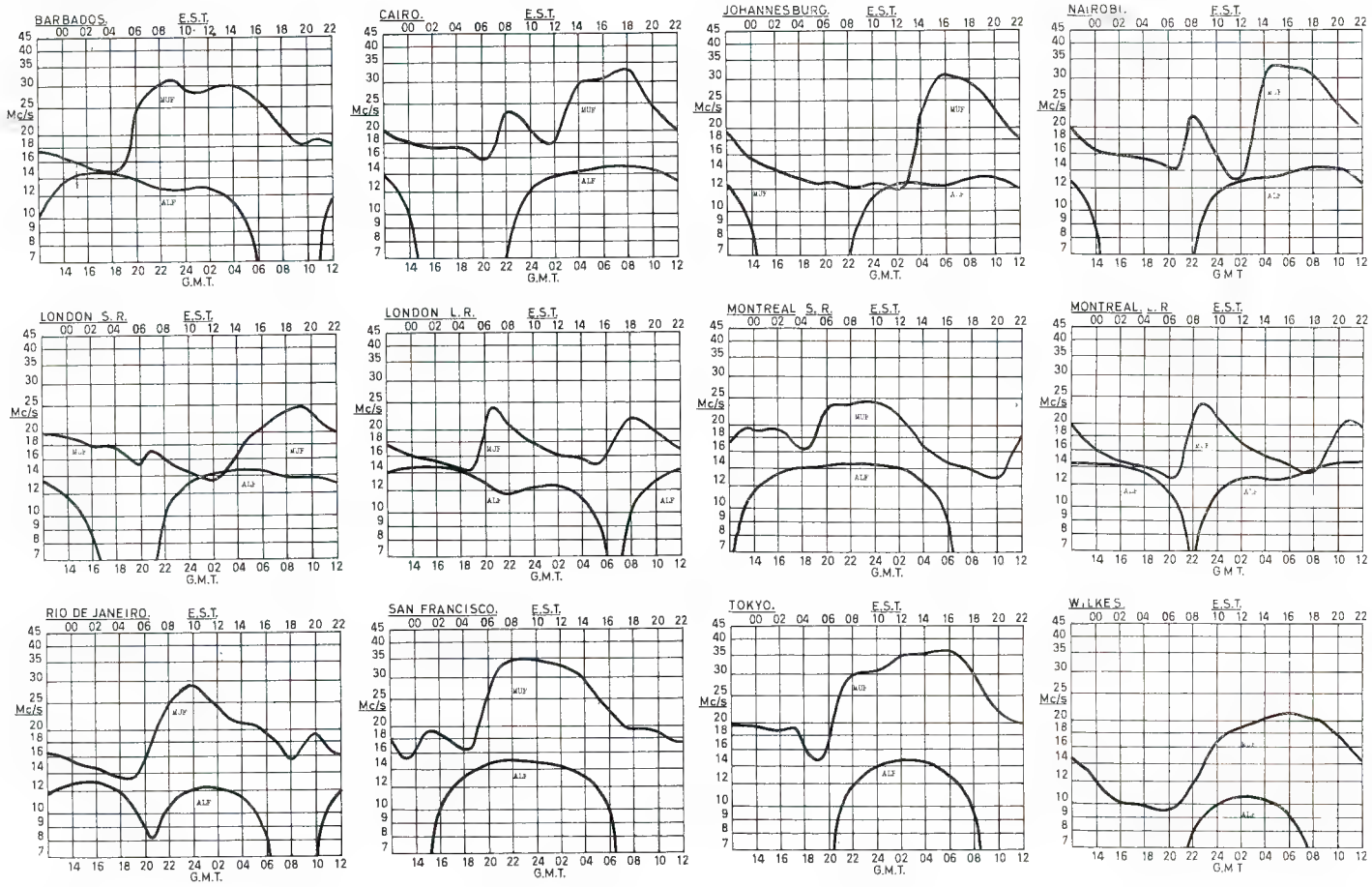
160 Metre DF Receiver, ZS2PD. To hunt that 160 metre hidden tx.

Two Valve Complete SSB Transmitter, by ZS2PX. 12AU7 and 6V6 in a phasing rig for one band.

A Method of Evaluating Slide Rule Answers, ZS1MM. For the mathematically inclined.

PREDICTION CHARTS FOR APRIL 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)



VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mount Lofty.
	144.800	VK5VF, Mount Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	144.500	VK6VE, Mount Barker (Albany).
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
	52.900	VK6TS, Carnarvon.
VK7	144.900	VK7VF, Devonport.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.

As far as I can ascertain the above list is correct. If there is something wrong with this listing would you please tell me now? Sorry I missed VK6VF on 145.000 last month. Note that ZL3VHF is on the same frequency, but interference seems unlikely! Anyway, you can always turn your beam to null out the offending beacon!

Southern Australia, in general, has returned to some sort of normality following the gigantic 144 MHz. opening extending from Albany in VK6 to Melbourne and possibly further east early in February. Bernie VK6KJ must have worked an enormous number of 2 metre stations, maybe I can have the number for next issue. Many operators worked Bernie over and over again. Another six stations worked Bernie on 12th Feb. and these included Herb VK3NN at Yanac, quite a long way inland. Since then there have been a number of times that the beacon VK6VE has been heard, probably the best being early on the morning of 25th Feb. by Colin VK5ZKR in Mt. Gambier, who reported signals to S9.

Word has been received that the output of VK7VF is down quite a lot, but no doubt will be rectified by the time this is read. Nothing has been heard of the progress on the construction of the beacon supposedly to be erected in VK3, nor any moves in VK2 to establish one so far.

U.H.F. RECORDS

Records are only made to be broken by others, I suppose, but they have certainly been tumbling lately. Firstly though, I want it known to a few ears that the contacts by Bernie VK6KJ into Melbourne do not constitute a 144 MHz. record. They certainly do for VK to VK contacts, but Hughie VK5BC still holds the overall record by working into ZL2 several years ago, but VK to VK will need something akin to Bernie working someone in VK4 to cause this one to tumble, but there is hope for the future now that VK4 have their beacon running. However, back to the discussion on records.

There seems every possibility the 432 MHz. record has been broken, but only by a few miles, so those checking the distances will need to be pretty sure of themselves. The contact was between Tony VK5ZDY at Stirling in the Mt. Lofty Ranges near Adelaide, and Peter VK3ZYO at South Oakleigh, not far from Melbourne. The distance is reputed to be 410 miles. Whether this finally settles to be the record or not, it certainly is a very fine effort by these two gentlemen and with signals 1 x 9 both ways must have provided them with a big thrill. The outcome is awaited with interest.

The prize winning plums of course must go to the 1296 MHz. band where records have been made and broken. Ron VK3AKC at Geelong and Wilf VK7WS at Burnie have been keeping skeds for four or five months and their efforts were rewarded on 4th Feb. (too late for inclusion in last month's notes) when two-way contacts were made at 2000 hours EST. Reports were VK7WF 449 and Ron 549, the distance being 223 miles, shack to shack. The next day, 5th Feb., at 1745 EST they exchanged phone signals at S9. Later, the same evening about 2300, Kevin VK3ZKB worked Wilf with reports: VK3ZKB 1 x 7, VK7WF 4 x 5. Kevin is at Nunawading, about 21 miles further north than Geelong, making a distance of about 250 miles, and thus snatching the record of a few hours' duration from Ron. Such is the luck of the game of course, but congratulations are due all round, and Ron has the consolation that through his continued efforts a record was finally established on the band, in excess of that earlier made in VK4. Following are a few brief details of equipment used, kindly supplied by Peter VK3ZYO.

VK7WF: Varactor type MA4060 tripler from 144 to 432 MHz., followed by 3CX100AS valve tripler to 1296 MHz., using the R.S.G.B. strip line design. The 2 metre exciter is an s.s.b. job with carrier reinserted. The rx line-up is a crystal diode mixer to a FET i.f. amplifier on 28 MHz. into a Yaesu Musen FR400 rx.

VK3AKC: Radial cavity tripler 2C39BA, running 3 watts output, with both the 432 MHz. driver and the 1296 MHz. tripler being modulated. Seven-foot dish with slot fed dipole about 40 feet high, 1N3ER diode mixer to 144 MHz. i.f.

VK3ZKB: Solid state equipment to 144 MHz., then MA4060 varactor to 432, giving about 20 watts, then into a u.h.f. transistor base-collector junction as a varactor, with about 3 watts output. Receiver uses CS2 mixer diode, 70 MHz. first i.f., 2.4 MHz. 2nd i.f. Four-foot dish about 30 feet high.

Another long haul contact on 432 MHz. was between Ray VK3ATN at Birchip and Wilf VK7WF on 5th Feb. This was at first reported in various on-air conversations as being a new record, but checking has revealed that this is not so, the distance being about 370 miles. Quite a good contact, however, and the participants would be well pleased.

Bob VK3AOT sends a very newsy letter, and some excerps are quite interesting. His caravan trip to Mt. Buninyong during Jan. netted him 420 contacts for eight days' operation on 52, 144 and 432 MHz. Filled with the joy of that period, he went out to Mt. Buffalo for the John Moyle National Field Day week-end. And what a week-end! A last-minute change of cars meant he could only take low power equipment with him, due to weight problems. These were not his only problems! First a boiling radiator, simultaneously a front tyre blow out. These fixed, Bob was blinded by the sun going up the mountain and crashed into a ditch, damaging the car, but worse still, wrecking his 32 element 432 MHz. colinear. Finally, they made it, 15 hours after leaving Melbourne, for a distance of 150 miles. They called their heads off for 15 contacts only, leaving for home at 1545 on the Sunday. More car trouble forced them to get only 6 miles in the first hour. Then a puncture. Jack won't work, damaged in crash! Finally got to within 15 miles of home and another puncture, this time towed to garage, home at 0100. All this would be just about enough to kill anyone's enthusiasm, but Bob indicates he expects to go to Mt. Buninyong over Easter with 52, 144, 432 and 1296 MHz. gear. Best contacts from Mt. Buffalo were to AX1ACA/1, the Canberra Radio Club on Mt. Ginini, and VK2ZKP/2 on Mt. Canobolis. Bob reports VK1ACA worked Ron VK3AKC at Geelong and Geoff VK3AMK at Frankston, and a couple of others for distances of some 300 miles over mountains. And on the Sunday morning of the N.F.D., Lance VK2ZKP/2 worked AX3AWI/3 on Mt. Blue, a distance of about 450 miles. A good effort.

Interested to note a comment in the VK6 V.h.f. Group News Bulletin that the John Moyle N.F.D. created virtually no v.h.f. interest in that State, principally because of the low scoring for v.h.f. contacts unless 52 MHz. opened to the eastern States. General opinion indicated that from their viewpoint, the N.F.D. was limited to the h.f. bands.

The contribution from VK5 for this year's N.F.D. would not be very great I am thinking. While the Eastern States were basking in good weather conditions and excellent v.h.f. conditions, producing contacts over many hundreds of miles, the weather in S.A. was foul to say the least. On the Saturday century heat conditions prevailed, culminating in the hottest day on the Sunday for 12 months, with the mercury around 105 degrees for hours on end. John VK5QZ and myself went out on to Mt. Gawler, some 15 miles north-east of Adelaide for the Field Day. All the gear was mounted in a caravan and we were operational on all bands from 160 metres to 432 MHz. Due to the hot weather, v.h.f. conditions just did not exist to allow contacts other than local and we ran up the poorest score for years on these bands. I am sorry to have to admit it, but had it not been for the h.f. equipment we had with us, we would have twiddled our thumbs for most of the period! We finally packed it in on the Sunday after sweltering in the caravan for hours, before 0900 it was above 100 degrees, reaching 112 degrees at 1030. When the heatsinks on the transistorised equipment got almost red hot around 1200 we went home. Undaunted, however, we will try again next year!

Ross AX4RO writes indicating quite a lot of interest by himself and the Townsville Amateur Radio Club in the suggested message handling of a few months ago. It appears the Townsville Club are probably able to look after the gap which exists in that State by manning a station at Bowen to get the message to Townsville and then on to Cairns. There is still one gap around Mackay which needs to be filled. I am looking for some help in this area and would be pleased to hear from anyone able to operate some 2 metre equipment in that area. Having achieved this, then I think the message can get under way. There then seems to be very little reason why a signal cannot travel from VK5 at least to northern VK4 and back again in a short period of time. I am currently looking into the matter of trying to bring the VK6s into it. More details as soon as possible.

AUSTRALIS OSCAR 5

The 144 MHz. beacon on Oscar 5 has finally gone into silence after operating so efficiently for several weeks, and giving more Amateurs the thrill of hearing a signal from space than any former orbiting package has done. The signal was so strong on occasions that with even rapid tuning of the band would make anyone stop and listen. The depth of modulation on the beacon was excellent and it is a great pity the 29.450 MHz. beacon is not working so well. All in all, however, a triumph of engineering for all concerned in the Project, and I feel sure I speak for the Amateur fraternity when I say "A job well done". These notes need not go further at this stage on this matter as I am sure a full report of the performance of Oscar 5 will appear in "A.R." from the pens of those more intimately concerned.

DX on 6 metres has now subsided except for an occasional opening, but this has certainly been compensated for by 144 MHz. Colin VK-5ZKR in Mt. Gambier writes that the boys down there have been right amongst the DX, adding that he had worked during February VKs 2, 3, 5, 6 and 7, while Ray VK3ATN went one better and worked VK1 during the N.F.D. week-end as well. Amateurs in the various southern States will be interested to know quite an upsurge in 432 MHz. activity is likely soon from Mt. Gambier. Colin VK5ZKR is already on and now Chris VK5ZFA is operating on s.s.b. with a QQE06/40 mixer. Col VK5CJ and David VK5ZOO are both building converters and Eric VK3ZTN at Hamilton showing quite a lot of interest. For antennas, the 32 element extended array is currently coming in for a lot of praise by a number who are using it. Colin says the path between Tony VK5ZDY at Stirling and himself seems to have shortened since erecting one himself, signals being considerably improved over the original 16 element phased array. Anyway, there may be no one left on v.h.f. in Mt. Gambier soon when we hear all the Z call chaps down there are swotting Morse and hoping to sit for the c.w. examination later this year!

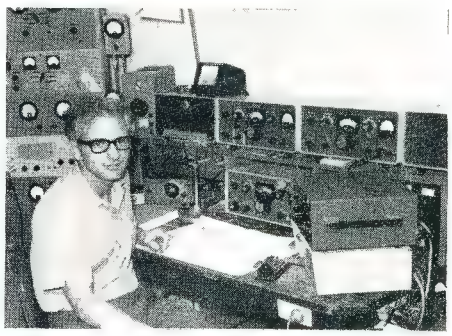
I guess that will have to do for this month. Before closing, here is the thought for the month: "It is not true that women want a great deal. A woman is quite content with very little, if that very little is precisely what she wants; if not, then nothing is enough." Hope everyone has a real "ball" with DX over the Easter week-end.

73, Eric VK5LP, The Voice in the Hills.

MEET THE OTHER MAN

Meet Eddie Penikis, 8/11 Northbourne Flats, Canberra City, VK1VP, formerly VK2AVP and VK9VP. Eddie has been known to hundreds of 6 metre operators for years and has certainly done much to keep Canberra on the radio map, so much so that he is a Life Member of the Canberra Radio Society. First licensed in 1952, Eddie operates on 52, 144, 432 and 576 MHz., and is certainly a man of many operating modes. His home station's details are as follows, briefly: 52, on c.w./a.m./s.s.b./f.m., running 100 watts to QQE06/40, with a 4 el. yagi 45 feet high. Transistorised converter with SE5020 in front end. On this band,

(Continued on Page 24)



Eddie Penikis, VK1VP

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

INTERFERENCE FROM RADAR-TYPE PULSES

Editor "A.R.," Dear Sir,

For some time past radar type pulses have been heard intermittently but loudly across the h.f. spectrum. At times the pulses exceed S9 and on the 15 and 20 metre bands are often heard simultaneously in Australia and Europe. The format of these "clicks" is a short train of sharp pulses apparently of high power, repeated at short intervals and followed by clearly recognisable echoes.

On occasions the resultant composite interference is so persistent and strong that even s.s.b. voice communication is interrupted. (Narrow band communications are not so seriously affected.)

On the night of 12th February when this noise was particularly persistent, I tape recorded a 15-minute sample showing how the pulses affected Amateur operation on the 15 metre band. This has been passed to the District Radio Inspector together with a formal request that something be done to minimise this type of emission.

The "signal" apparently originates in the Central Pacific and is said to be part of an exotic (American) ionospheric prediction system, which although attracting unfavourable comment from several sources, seems destined to continue unless the level of protest rises considerably.

Would members who are concerned about the selfish type of use of the h.f. spectrum in Region 3 please lodge an appropriate protest with either their local R.I., their W.I.A. Councillor and/or the A.R.R.L.?

—Col Harvey, VK1AU.

[Better still, refer it to your Intruder Watch Co-ordinator.—Ed.]

AUSTRALIA—AND CAPTAIN COOK

Editor "A.R.," Dear Sir,

I refer to VK1JG's opinion expressed on page 26 of "A.R." Mar. 1970, in which he makes an awful "boob," in my opinion, by saying that he hears "nonsense on the air" in relation to the Australian call signs, and then offers his version of what the "so-called" nonsense should become.

I refer Mr. George to the Radio Regulations, Geneva 1968, page 234, Regulation 772/21(1), which, in relation to call signs, reads as follows:

> "Amateur and experimental stations -one or two letters and a single digit (other than 0 or 1), followed by a group of not more than three letters"

and

> "773 (2) However, the prohibition of the use of the digits 0 and 1 does not apply to amateur stations".

To the writer and, I hope, to all average, clear thinking readers, the aforesaid regulations clearly sets out the Amateur Radio call sign position.

Insofar as VK1JG is concerned, I feel it's a case of the boot being on the other foot, with "all this nonsense on the air" being applicable to Mr. George if he introduces the word "Australia" into preceding his call sign.

—Eric Trebilcock, AX-L3042.

"SIT AND THINK"

Editor "A.R.," Dear Sir,

I wish to offer my sincere congratulations to those responsible in the Wireless Institute of Australia for the inauguration of the Cook Bi-Centenary Award. In line with other segments of our Australian community, we certainly have something to celebrate and I think the majority of Amateurs will support the W.I.A. in a magnificent effort to create greater interest in our young country by communication with Radio Amateurs throughout the world.

Monitoring the 20 metre band since the beginning of January this year, I have noticed a welcome increase in c.w. and s.s.b. activity and from comments on the air it would appear that the AX Award has contributed to a large degree to this increased activity.

However, as the English mathematician, Sir Isaac Newton, stated in 1700, "To every action there is an equal and opposite reaction", I now refer to an international incident monitored recently on the 20 metre band:

Scene 1: American Amateur: "Say OM, you are using the VK prefix, how about the AX prefix to give me another contact?"

Australian Amateur: "Sorry OM, I don't alter my call sign for anybody."

Scene 2: American Amateur in a long QSO with a VK5 over the long path. American asks for an AX prefix. Australian Amateur disappears.

Scene 3: A VK2 character, well known for his sales ability, stated on the 40 metre band: "Captain Cook did not discover the East coast of Australia and I will not use the AX prefix."

Scene 4: Have a listen to the VK2 characters who work a daily net on 7.1 MHz., particularly at 9 a.m. after they have had a bad night and try to get an AX prefix out of them.

I conclude by suggesting that there are a number in our ranks who should sit and think, and having sat in contemplation, thank the good Lord that they are part of a young country built on a heritage of courage and endeavour.

I await their reply.

—Wal E. Salmon, VK2SA.

RADIO TELETYPE INTERFERENCE

Editor "A.R.," Dear Sir,

From conversation with other Amateurs it appears to me that a lot of r.t.t.y. Amateur-band interference is blamed on Amateurs. Those who may be interested in the encroachment on the Amateur bands should note that, in my experience anyhow, Amateur r.t.t.y. operators transmit just outside the phone bands in the c.w. section only (over a narrow section at that).

It is a very simple matter to determine if the r.t.t.y. operator is an Amateur as QSOs are of the same form as phone QSOs, of comparatively short duration, and also the Amateur finishes each over with his call sign in c.w.

So be happy in the knowledge that the r.t.t.y. QRM spoiling the bands, 20 metres especially, is not caused by your fellow Amateurs.

—Peter H. Brown, VK4PJ.

CHANGE OF ADDRESS

W.I.A. members are requested to promptly notify any change of address to their Divisional Secretary —not direct to "Amateur Radio".

OBITUARY

VINCENT JEFFS, VK4VJ

The VK4 Division recently suffered a severe loss in the passing, aged 58 years, of Vince Jeffs, VK4VJ, an extremely popular member, who was comparatively recently elected a Life Member for his services to the Division.

Vince, who passed away while in hospital, had some two years ago retired from business because of ill health and, while in hospital on that occasion had the misfortune to lose his wife.

To son and married daughter, VK4 members extend their sympathy.

Vince, licensed in 1931, was one of the earliest experimenters on s.s.b. and in the use of transistors. He willingly passed on his knowledge.

His interest in field days, Scouting, conventions, etc., was evinced by his full participation, while he operated VK4WI for a time and as a capable telegraphist he handled Morse sessions.

Vince, well spoken and with a fine sense of humour, will be missed for many days.

CONTEST CALENDAR

Until 19th April: I.A.R.C. Propagation Research Contest (Phone).

11th/12th April: "CQ" W.W. WPX S.s.b. Contest

15th/16th August: Remembrance Day Contest.

3rd/4th October: VK/ZL/Oceania DX Contest, Phone Section.

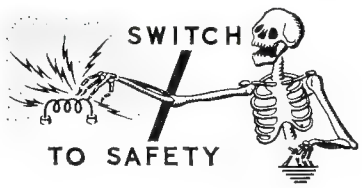
10th/11th October: VK/ZL/Oceania DX Contest, C.w. Section.

10th/11th October: R.S.G.B. 28 MHz. Phone Contest.

24th/25th October: R.S.G.B. 7 MHz. DX Contest (C.w.).

7th/8th November: R.S.G.B. 7 MHz. DX Contest (Phone).

5th Dec., 1970, to 11th Jan., 1971: Ross A. Hull V.h.f. Memorial Contest.



WIRELESS INSTITUTE OF AUSTRALIA
FEDERAL EXECUTIVE

The Institute can now offer annual subscriptions to following Amateur Journals:

★ **"QST"—Associate membership and renewals, $6.40.**

★ **R.S.G.B. "Radio Communication" (ex "The Bulletin") is only sent with membership of Society. $5.50. Send for application form.**

★ **"CQ" Magazine, $5.70; Three Years, $13.50.**

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FEDERAL AWARDS

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The following additional stations have qualified for the Award:

Cert. No.	Call	Cert. No.	Call
41	KG4AL	73	AX4XJ
42	AX5EJ	74	ZM3AAA
43	AX8RO	75	ZM3TC
44	AX3HL	76	W5QKZ
45	AX7KW	77	ZM1QW
46	AX3ZE	78	VQ8CR
47	UB5WE	79	AX4HA
48	XW8CS	80	AX4DV
49	AX6WT	81	OH2BAD
50	AX9BS	82	VS6AM
51	KA9MF	83	KP4CL
52	UA9BE	84	ZM2BGV
53	HR1WSG	85	KG4AS
54	CP1GN	86	HR1KAS
55	LA8JI	87	AX5EF
56	ZM2GJ	88	KH6IU
57	ZS5PG	89	G3UXN
58	ZL1AMN	90	ZM2LJ
59	AX2EK	91	AX6RU
60	AX7BJ	92	W6RU
61	AX4VX	93	W1AA
62	W3ATO	94	K6GKU
63	AX7DK	95	DL1MM
64	AX2XT	96	HS1ABA
65	AX4WY	97	WA5SMM
66	AX8KA	98	AX3GA
67	ZM3HN	99	AX2KK
68	AX2OQ	100	ZL3VX
69	KP4AST	101	ZL4NH
70	G3VPI	102	AX3EF
71	AX2PF	103	DJ5DA
72	JH1EXV		

— . . . —

VK3 S.W.L. GROUP

REGISTERED S.W.L. NUMBERS

Due to the fact that the Short Wave Listener Group have been without a Secretary for some time, records have got into arrears. We are happy to announce that the position has now been filled and we want to rectify any anomalies that could exist.

Would all members who have applied for an S.w.l. number and have not as yet received it, please communicate direct with the Secretary, who will then answer by return mail.

Please contact:

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21 King William Street,
Reservoir, Vic., 3073; or Phone 47-1376.

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CAPTAIN COOK BI-CENTENARY CELEBRATIONS, 1970

Expedition to Cape Hicks

During April 1970 representatives of the Victorian Division of the Wireless Institute of Australia will be operating an Amateur Radio Station at Cape Hicks, the first point of the Australian coastline sighted by Captain Cook in 1770. The Amateur Radio Station, using the call sign AX3AWI/Portable, will contact Australian and overseas Amateur Stations during the three-day period of operation.

DETAILS

Date: 18th, 19th and 20th April, 1970.

Call Sign: AX3AWI/Portable.

Location: Cape Hicks, Victoria, Australia.

Bands: 15, 20, 40, 80 and 160 metres, also v.h.f.

Times: 0200 GMT 18/4/70 to 0200 GMT 20/4/70.

QSL and Awards—A special certificate and QSL card will be issued—applications via VK QSL Bureau, or direct to address below.

Further information can be obtained by contacting Russell Kelly. AX3AG, Divisional Secretary, W.I.A. Vic. Div., P.O. Box 36, East Melbourne, Vic., 3002.

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries. Where totals are the same, listings will be alphabetical by call sign.

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	316/340	VK5AB	297/314
VK6RU	313/338	VK4KS	289/304
VK3AHO	311/326	VK4FJ	285/305
VK4HR	309/328	VK4TY	284/288
VK2JZ	307/325	VK2APK	277/283
VK6MK	303/323	VK3TL	271/277

New Members:

Cert. No.	Call	Total
105	VK6WY	103/103
106	VK3AKZ	103/105
107	VK5EF	99/100

Amendments:

VK3ZE	241/244	VK3TG	164/168
VK3AMK	211/211	VK4RF	160/160
VK5BB	190/193		

C.W.

VK3AHQ	301/315	VK3YL	272/289
VK2QL	300/323	VK3XB	270/287
VK4FJ	290/315	VK3ARX	269/278
VK4HR	287/309	VK6RU	266/289
VK2AGH	282/296	VK3NC	263/286
VK2APK	274/282	VK4TY	259/272

Amendment:

VK4RF 146/158

OPEN

VK6RU	314/339	VK6MK	304/324
VK4HR	313/338	VK2EO	302/325
VK2AGH	312/332	VK4FJ	297/322
VK2VN	308/325	VK2APK	294/305
VK4SD	306/321	VK3ARX	292/301
VK4TY	306/321	VK4KS	290/309

New Member:

Cert. No.	Call	Total
122	VK5EF	101/100

SILENT KEYS

It is with deep regret that we record the passing of—

VK3KX—Ronald Tandy
L-3324—Jeff Van Loon
VK4VJ—Vincent Jeffs

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FOR SALE: FR50 Receiver, six Ham bands only, plus WWV, perfect order with 12v. transistor supply, $150 o.n.o. One Palec Valve Tester with built in Multimeter, $15. One S.W.R. Meter, 75 ohms, $15. 62 Set, poor working condition and appearance, with extra kit of valves, $25 o.n.o. Call Sunday or write. VK3ZZV, G. Fella, 8 Hilton St., Glenroy, Vic., 3046.

FOR SALE: Galaxy 3, S.s.b. Transceiver, complete with matching power supply and speaker, crystal calibrator and vox. $325. Phone 560-0645 (Melb.).

FOR SALE: Galaxy 5 Transceiver, perfect condition, with mic., vox, a.t.u., power supply, handbook, $420. Phone Melb. 82-7308. VK3ZZX, 4/24 Auburn Gr., Hawthorn, Vic.

FOR SALE: General Coverage Communications Rx AR8 front end, double conversion, 18 valves, BFO, prod. det., S meter, enclosure incomplete. Photographs available. $70 o.n.o. WIA-L3377. T. Hambling, 88 Bayview St., Williamstown, Vic., 3016. Phone 397-6773 (Melb.).

FOR SALE: Hallicrafter SX101, Mk. 2, Ham-band Rx, 160-10 metres. Switched SBs, xtal cal., 0.5 KHz., c.w. sel. Excellent performer. VK4FD, C. B. Steggink, 38 Moncrieff St., Bundaberg, Qld., 4670.

FOR SALE: VK3APC Transistorised Amateur Band Receiver, 12v. d.c., "S" meter, 3.5 Kc. marker (no xtal), professionally built; had little use, $55. M. Batt, Rokewood Junction, Vic., 3351.

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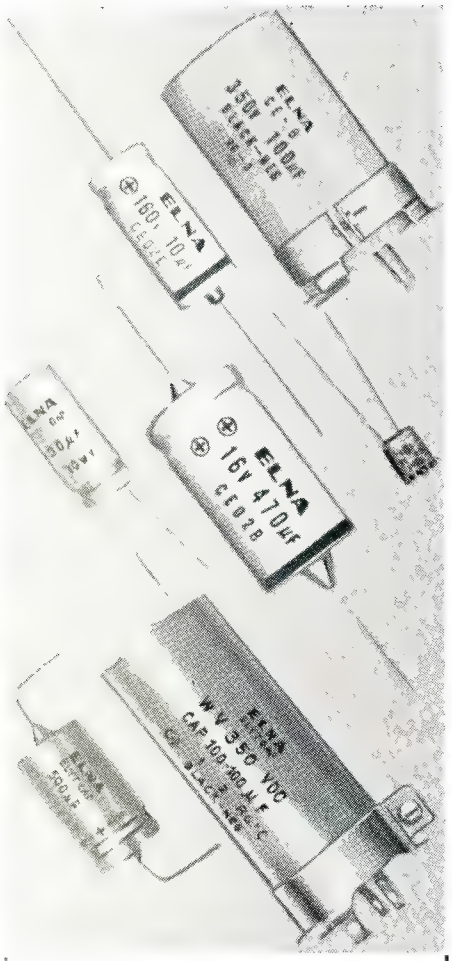

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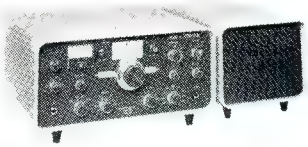

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EDDYSTONE
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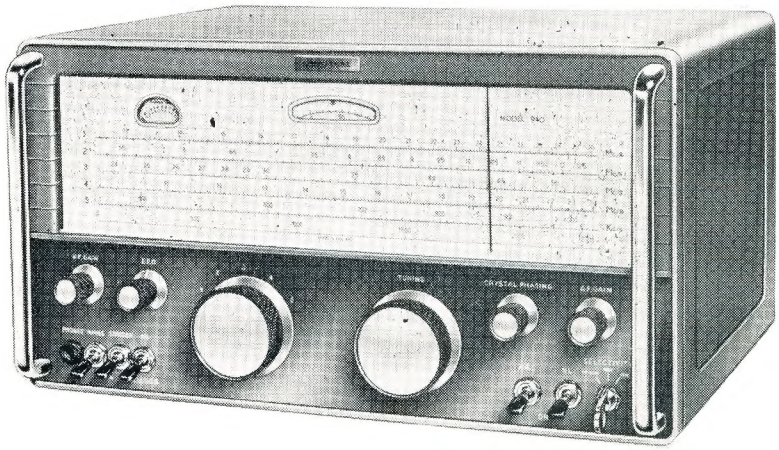
Model "940"



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Amateur Net Price: $540.88 + 25% S.T.

FEATURES—

- **Cascode type 1st RF amplifier stage.**
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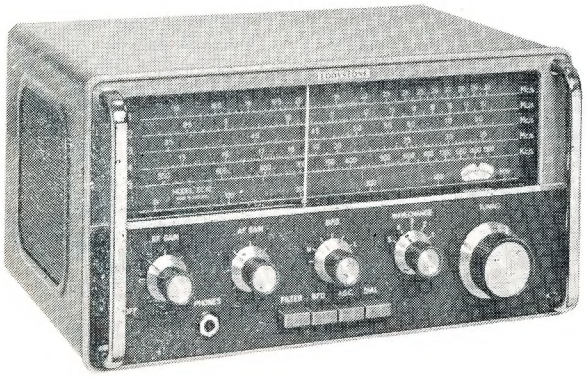

Amateur Net Price: $179.40 plus 25% Sales Tax

FEATURES—

- **Adequate bandspread, correct degree of selectivity for the various modes of signal, ease of tuning SSB signals, and frequency stability.**
- **Continuously variable selectivity in the 100 KHz. second IF stages, crystal filter can be switched in to give an extremely narrow band for CW.**
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- **Large S meter, each division 6 db. change of level.**
- **Image rejection better than 50 db. at highest frequency and proportionally greater at lower frequencies.**

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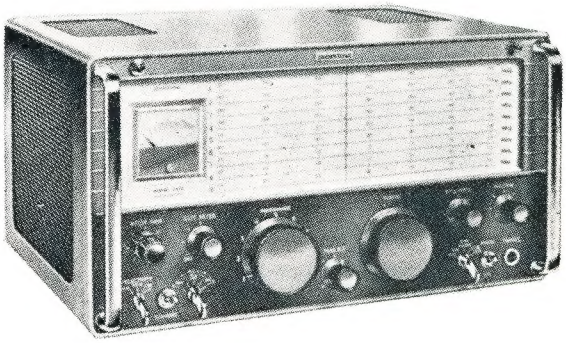

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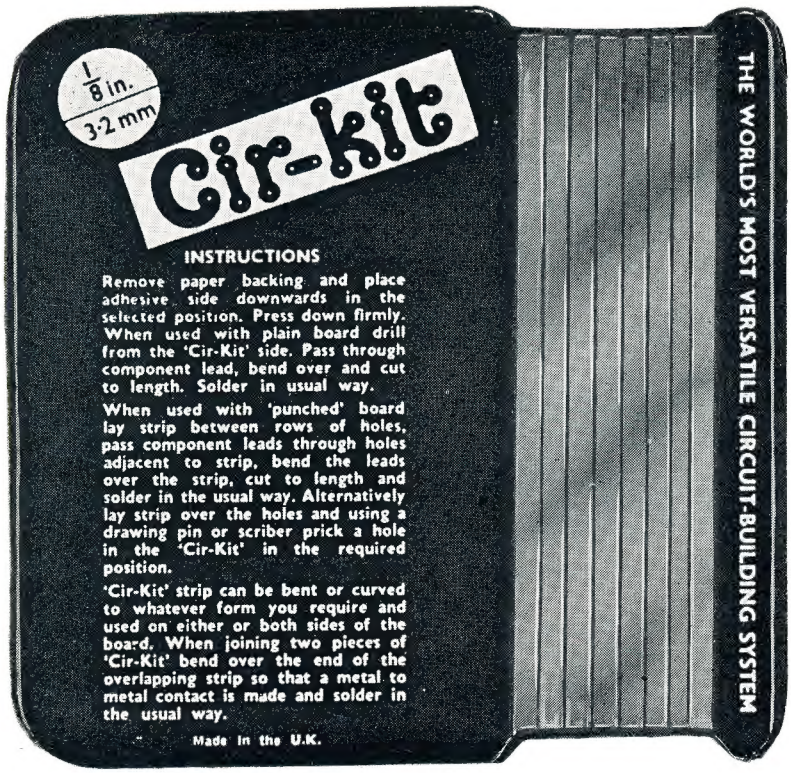

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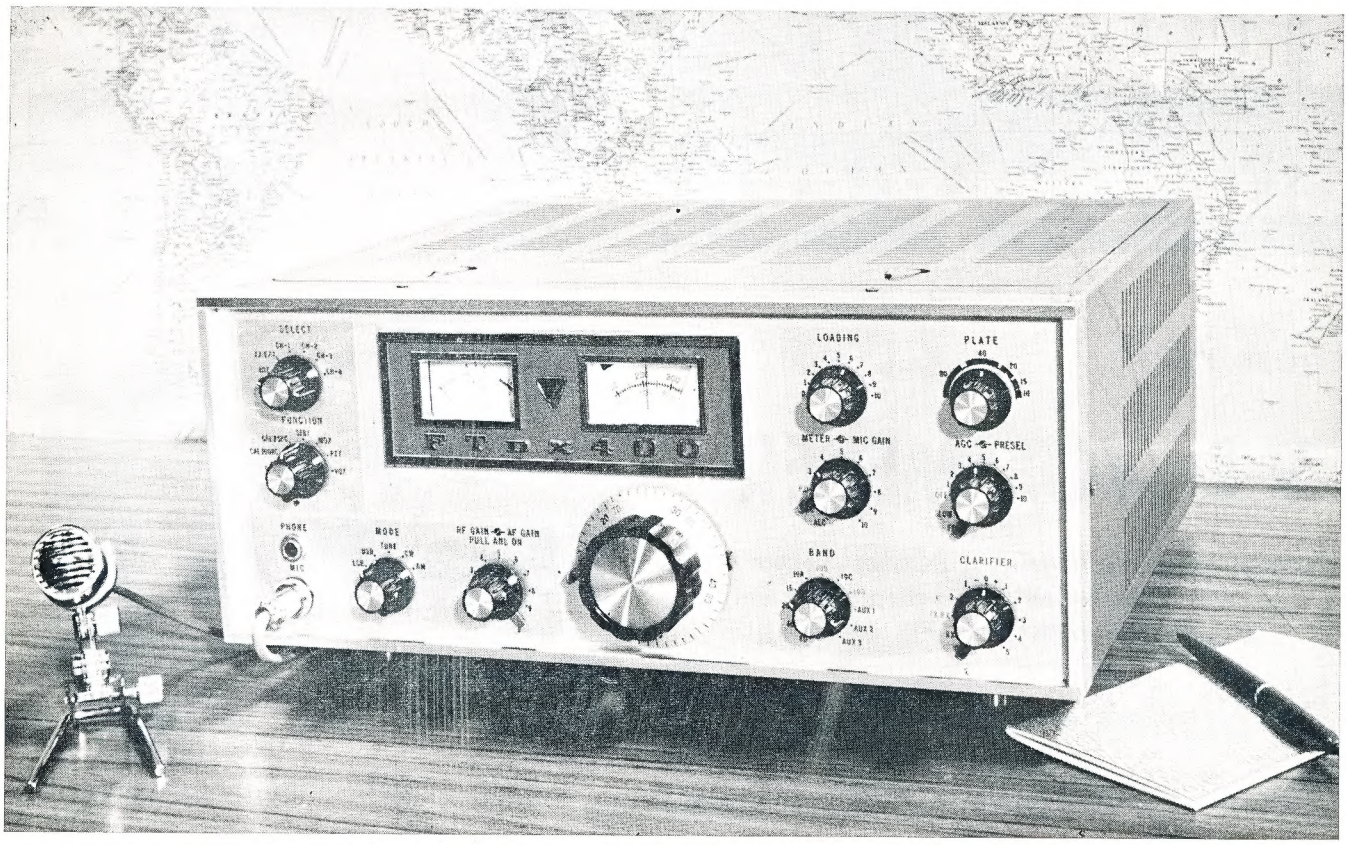

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- ★ Sidetone CW monitor.
- ★ Multi-scale panel meter, fully calibrated, provides direct reading of PA current, plus relative power output, ALC indication, Rx "S" units.
- ★ Offset tuning, plus or minus 5 Kc. is provided by clarifier control, which is selectable Off, Rx, Rx and Tx.
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- ★ VFO dial readout of 1 Kc.
- ★ Dial forward reading all bands.
- ★ Provision for external VFO for split frequency operation, switch selectable for transmitting or receiving.
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- ★ Fast and slow selectable receiver AGC.
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Accuracy:

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AC Volts: ,, ,, ±3% ,, ,, ,,
Resistance: ,, ,, ±3% of centre scale value.
D.B.M.: ,, ,, ±4% d.b.m. at 0 d.b.m.

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